COMMUNICATIONS TECHNOLOGY

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November 1992

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The first Signal Level Meter designed to pinpoint RF/video problems and performance test any RF distribution system more accurately than any other Signal Level Meter.

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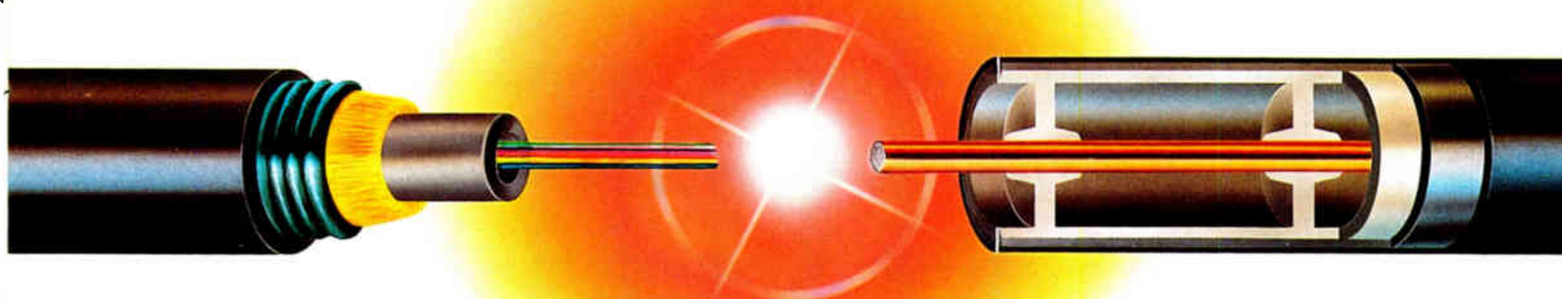

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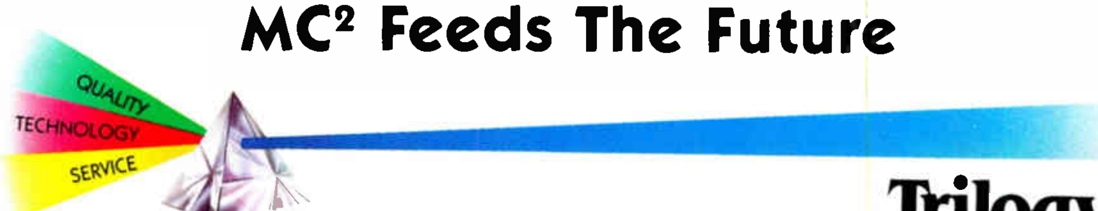

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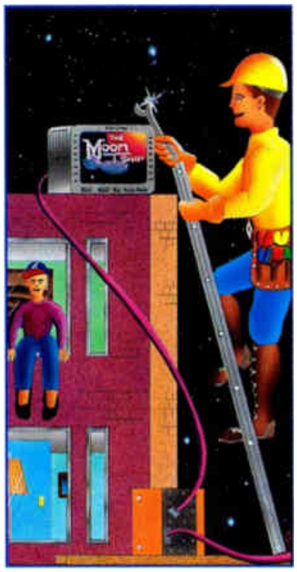
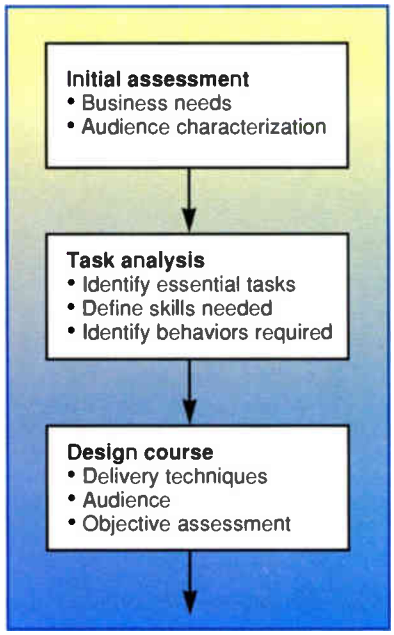
Departments



Back to Basics 49



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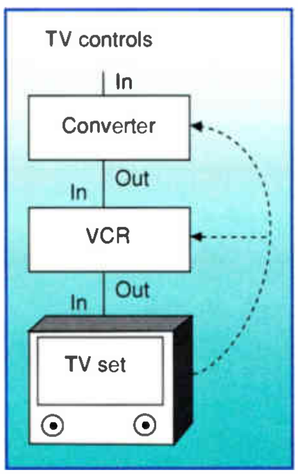
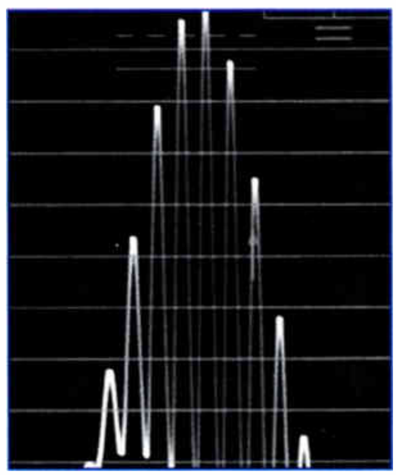


Addressability's future 26



Measurements 34

Features

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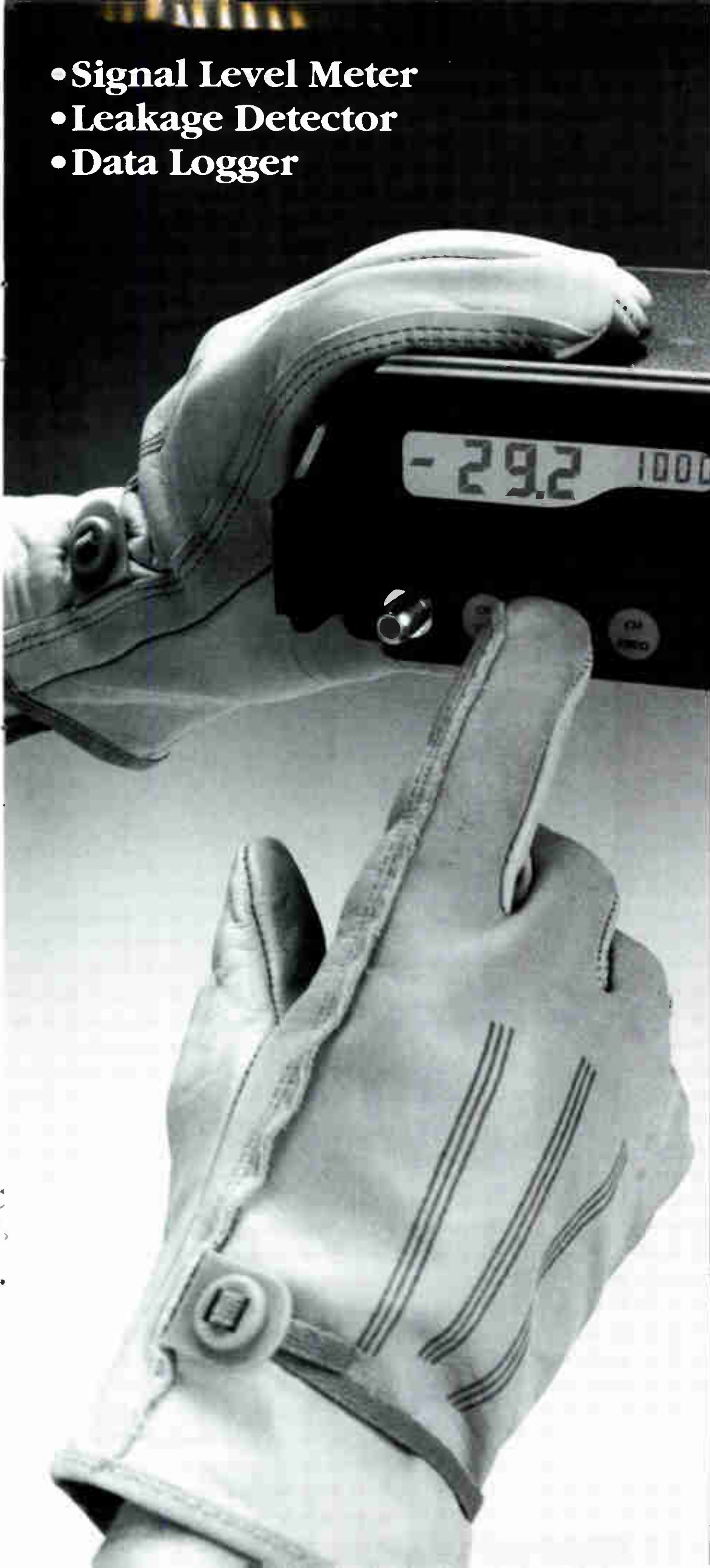

Tricorder

From Trilithic

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EDITOR'S LETTER

Re-reg: Mostly politics

I can't imagine that you haven't heard by now, but just in case: Congress overrode President Bush's veto of the cable re-regulation bill last month. It's not particularly good news, but it's not particularly a surprise either. I would estimate that the bill's success was about 30 percent *we had it coming* and 70 percent *politics.*

First, the *we had it coming* part: high rates and lousy service. Plain and simple. What got government's attention in the first place? Complaints that rates went up too much since de-regulation and that service didn't seem to improve by a like amount. Unfortunately we had too many operators who got too greedy and too often those same operators ignored the fact that ours is a service business.

Undoubtedly the new re-reg legislation will wind up being modified as a result of inevitable court battles. But when it's all said and done, we'll still be regulated in some fashion, and that won't necessarily be all bad. But it does mean we need to look at our past mistakes and learn from them. Service has to come first. From a technical standpoint, our customers expect and deserve no less than the best quality and reliability we are capable of providing.

Now the *politics* part: Our system of government is broken, plain and simple. Not only does re-reg legislation have "special interest" written all over it, but even the title hints at problems with the system. On the surface, "Cable Television Consumer Protection and Competition Act" sounds good. When you get down to it, what is the most important part of a congressman's job? That's easy. Getting re-elected! And what better way to remain an incumbent than to embrace politics that will supposedly help the folks back home? That attitude is one reason our federal government spends something like $100 billion every year on pork barrel projects that no individual politician would support in anyone else's backyard except its own. Sadly, the system has degenerated into one of trading votes for the favors of special interests, political action committees (PACs) and even other members of Congress — "you support mine, I'll support yours."

In the case of re-regulation, whether or not individual congressmen actually like or dislike cable TV is beside the point.

Getting on the bandwagon of such an apparently pro-consumer piece of legislation will hopefully deflect some of the earlier criticisms of the House banking scandal, the budget deficit, the national debt, the general shape of the economy, etc. "Re-elect me! I supported re-regulation of that monopolistic, evil cable industry."

It's even sadder when you realize that despite who is elected president, little will change. The system is too entrenched in its own bureaucracy and corruption to allow any president to significantly influence the way things are done. If the system is going to change, those changes have to begin with you and me. Are you a registered voter? If so, do you vote in every election? If the answer is no to either question, why not? I personally believe it's also time to seriously look at possible solutions such as term limitations, presidential line item veto, elimination of PACs (and maybe lobbying altogether) and a balanced budget amendment.

Where's "Lab Report?"

If you've been wondering what happened to "CT's Lab Report" during the past few issues, the column is on a brief break while arrangements for a new test facility are underway. A few months ago, Jones Intercable mothballed its corporate engineering lab (where most of our evaluations were conducted) after Frank Eichenlaub moved over to TCI. Word has it that Jones plans to hire a replacement. As soon as we finalize plans for access to a new facility, the "Lab Report" will be back.

Ronald J. Hranac
Senior Technical Editor

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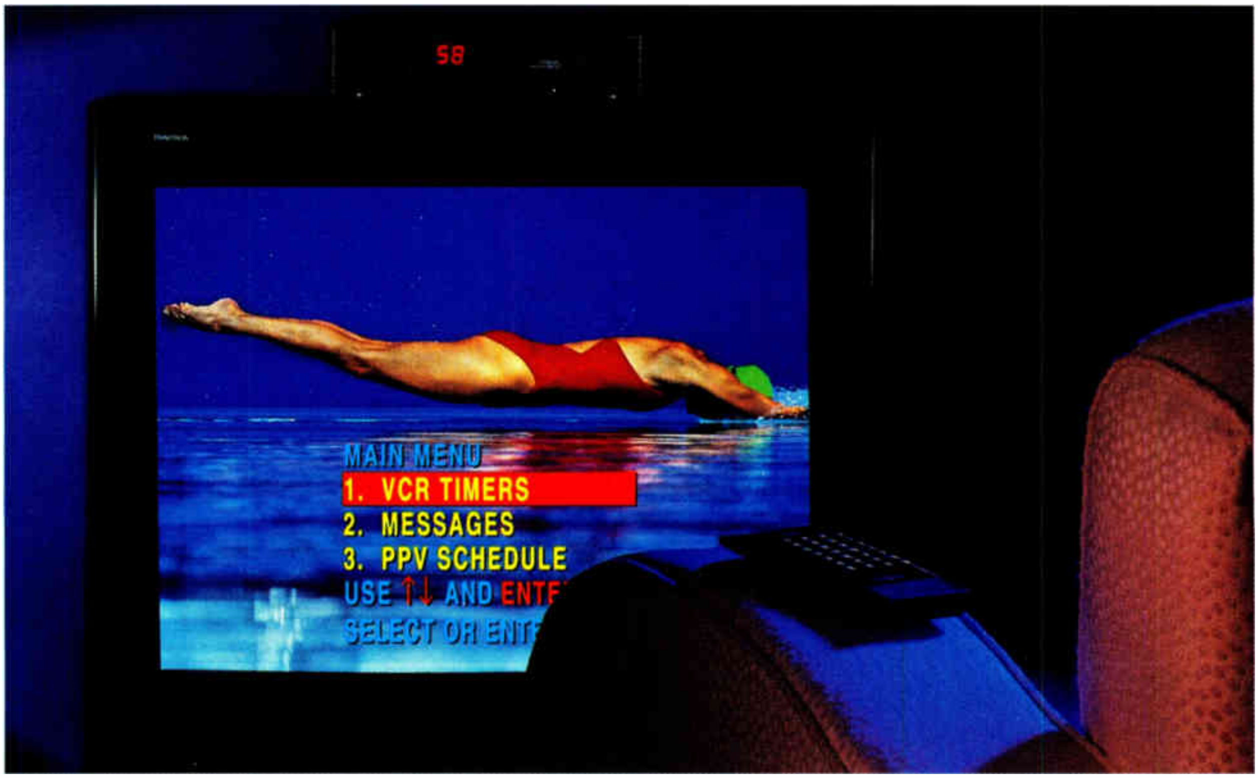

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No matter where or how your subscribers watch TV, they want it easier. Who can blame them? Too often, their cable equipment doesn't offer all the features of the latest TVs or VCRs. Now Jerrold provides the features that make even the easy chair easier.

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Jerrold makes these new advanced, yet simpler features available so you can offer them to your subscribers today. After all, a happy subscriber is what we all want. We're ready now.

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Reader Service Number 26

Congress overrides Bush cable TV re-reg veto

WASHINGTON, D.C. — After the House and Senate agreed to a conference report reconciling differences in their cable bills, President Bush held to earlier promises and vetoed the bill. However, those opposed to the bill were unable to secure the votes needed to sustain the veto in the Senate or House. It marks the first time Bush has had a veto overridden.

The attention now turns to the Federal Communications Commission (where costs to implement the act are estimated to exceed $20 million per year over the next six years), the federal courts (where Turner Broadcasting has already filed a suit to invalidate the must-carry and retransmission consent provisions of the act as unconstitutional) and the local markets.

SCTE sponsors Eastern Show tech sessions

ATLANTA — The Society of Cable Television Engineers sponsored technical sessions at the Eastern Show on the FCC regs, fiber, outages and more.

Dick Amell of Metrovision discussed new FCC regs on closed-captioned data, complaint resolution procedure, proof-of-performance testing and carrier-to-noise (C/N). On the new 36 dB C/N requirement, Jonathan Kramer, president of Communications Support Corp., remarked, "Those systems that don't meet the 36 dB standard don't have subscribers, they have prisoners."

Charles Mogray of Comm/Scope gave an overview of fiber placement and stressed the uniqueness of each situation, practicing safe operations and knowing the maximum allowable pulling tension and bending radius of the cable.

Effective management techniques were the topic of a session with Rouletti Vick of Georgia Cable TV & Communications, who offered helpful communication techniques and urged recognition of cultural differences and social backgrounds.

Outage control was addressed by Scott Bachman of CableLabs. Detection and tracking, system reliability, plant powering and protection of outside plant and headends were discussed.

- The Advanced Television Research Consortium reported it successfully presented the nation's first live simulcast over a major-market station with its Advanced Digital HDTV system.
- Amphenol Corp. agreed in principle to acquire Times Fiber Communications via a merger of LPL Technologies, a holding company for Times Fiber, into a newly formed subsidiary.
- Emily and Glyn Bostick, founders of Microwave Filter, formed a new company, Communications & Energy Corp. The Syracuse, N.Y.-based firm will specialize in filters and electronic products. The phone number is (315) 452-0709.

Light up your fiber with the best broadcast quality video possible.

With more broadcasters and CATV operators realizing the benefits and switching to fiber optic networks, the demand for "signal purity" and higher signal quality transmission has increased.

DX sheds a new light on high performance for today's cable operators with the new DIR-657 integrated receiver/ descambler. With a long list of features, including RS-250B broadcast quality performance and optional RS-232C interface for remote operation, the new DIR-657 outshines all other satellite receivers in delivering the sharpest video and soundest audio signals possible.

For more information write to DX Communications Inc., 10 Skyline Drive, Hawthorne, NY. 10532 or call (914) 347-4040.

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Reader Service Number 13

Society seminar: Emerging Technologies

The Society of Cable Television Engineers will kick off 1993 with a new seminar, its 1993 Conference on Emerging Technologies, which will be held Jan. 6-7 in New Orleans. Formerly known as SCTE's annual Fiber Optics conference, this year's event has been expanded to incorporate other important technological advances impacting our industry.

Attendee registration packages for the conference will be mailed to all active members in the near future. However, the following is a preliminary schedule of events for our 1993 Conference on Emerging Technologies.

Tuesday, Jan. 5
- 1-5:15 p.m. — Preconference tutorials
- 4-7 p.m. — Registration
- 6-8 p.m. — Reception

Wednesday, Jan. 6
- 8:30-9 a.m. — Opening remarks
- 9 a.m.-Noon — Session A: Fiber-Optic Technology
- Noon-1: 45 p.m. — Lunch with keynote speaker
- 2-5 p.m. — Session B: Digital Compression and Distribution Techniques
- 5-7 p.m. — Tabletop displays
- 7-9 p.m. — Reception

Thursday, Jan. 7
- 8:30 a.m.-Noon — Session C: Cable's Future Challenges
- Noon-1:45 p.m. — Lunch with keynote speaker
- 2-5 p.m. — Session D: TV Systems of the Future
- 5-7 p.m. — Tabletop displays and cocktail reception

The registration fee is $195 for SCTE members. Preconference tutorials were designed to bring attendees up-to-date on technical basics/terms to be discussed at the conference. Tutorial attendance is optional at a small additional cost.

The conference will be held at the Hilton and Towers located on the Mississippi River in downtown New Orleans. Discounted room rates are $132 single/double for a standard room and $149 single/double for executive accommodations. The Hilton is presently taking reservations, which may be made by calling (504) 584-3999.

Again, complete registration packages will be mailed in the near future. For more information, please contact SCTE at (215) 363-6888.

Subcommittees set 1993 calendar

SCTE now has six technical subcommittees operating under its Engineering Committee. Each subcommittee plans to meet prior to the Western and Texas Cable Shows and the Society's own Cable-Tec Expo, as listed in the following schedule:

Western Cable Show
Tuesday, Dec. 1, 1992 (Hilton in Anaheim, Calif.)
- 2-3:30 p.m.— In-Home Cabling Subcommittee

Maintenance Practices and Procedures Subcommittee →

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Emergency Broadcast System (EBS) Subcommittee

• 3:30-5 p.m. — Interface Practices Subcommittee
Design and Construction Subcommittee
CLI Subcommittee

Texas Cable Show
Wednesday, Feb. 24, 1993 (San Antonio, Texas, Convention Center)
• 8-10 a.m. — In-Home Cabling Subcommittee
Maintenance Practices and Procedures Subcommittee
EBS Subcommittee

• 10-11:30 a.m. — Interface Practices Subcommittee
Design and Construction Subcommittee
CLI Subcommittee

Cable-Tec Expo '93
Tuesday, April 20, 1993 (Orange County Convention Center, Orlando, Fla.)
• 2-3:30 p.m. — In-Home Cabling Subcommittee
Maintenance Practices and Procedures Subcommittee
Emergency Broadcast System (EBS) Subcommittee

• 3:30-5 p.m. — Interface Practices Subcommittee
Design and Construction Subcommittee
CLI Subcommittee

The CLI Subcommittee recommends educational training, reviews published materials and provides recommendations toward the possible compilation of an SCTE CLI handbook. It also reviews and reports on field problems through publication in the SCTE newsletter, *Interval*.

The Design and Construction Subcommittee deals with basic construction, fiber construction, design (including CAD and engineering, makeready and mapping), upgrades and rebuilds.

The EBS Subcommittee is working with the Federal Communications Commission in response to its pending Notice of Inquiry for EBS. Working groups operating under its auspices report on hardware alternatives and current local and regional EBS efforts.

The In-Home Cabling Subcommittee was formed to discuss cabling, architecture, passives, in-home amplification, connectors, test procedures and intrapremises cabling.

The Interface Practices Subcommittee was established to address the problems associated with the various interfaces between cables, connectors and equipment housings, in both the drop and mainline plant. Founded in 1987, this subcommittee was the first of SCTE's efforts at establishing "specifications" and requirements for new and, in some cases, existing products. Its first such accomplishment was the standardization of the female F-port, which was developed after two years of effort. Not only has this standard been accepted by SCTE and the U.S. cable TV industry, but is currently being considered by CENELEC as a standard for broadband communications connectors throughout Europe.

The recently organized Maintenance Practices and Procedures Subcommittee plans to develop recommended practices and procedures for the proper maintenance of cable TV systems.

The SCTE engineering subcommittees all are planning to meet four times per year. All SCTE members are invited to attend and participate. For further information, contact SCTE at (215) 363-6888.

A Touch Away From What's On Cable

Zenith's on-screen system "gateway" let's you customize screens to fit your needs today and in the future.

The age of interactive electronic program guides is here, and Zenith's new HT2000 converter with advanced on-screen information system is ready. All it takes is one touch of the "Guide" key on the remote control, and subscribers can access programming like never before. Find out what's on when. Sort programming by favorite themes. Get extended information. Program the timer. Order pay-per-view. It's all there and easy to use. ☛ Of course, we also have menus for bulletin boards, messaging, converter features and a place to add information services when you're ready. So, call today and see how the HT2000 will put your subscribers in touch with cable. 708-391-7702.

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Reader Service Number 17

BOOKSHELF

The following is a listing of videotapes currently available by mail order through the Society of Cable Television Engineers. The prices listed are for SCTE members only. Non-members must add 20 percent when ordering.

☛ *Developing a Technical Training Program* — Roger Keith, formerly of Warner Cable Communications, now with NCTI, discusses the design and development of a system level CATV technical training program. This program was videotaped at Cable-Tec Expo '88 in San Francisco. (1 hr.) Order #T-1065, $35.

☛ *High Definition Television* — Walter Ciciora of ATC, Wayne Luplow of Zenith Electronics and Norman Hurst of David Sarnoff Research Center briefly review the basics of HDTV, going on to discuss intermediate technologies such as advanced TV (ATV) and ACTV. Delivery of these signals by cable, as well as competitive technologies, are also discussed. This program provides an understanding of how HDTV can affect your systems in the years to come. (1-1/2 hrs.) Order #T-1066, $45.

☛ *Digital Video, A Future Alternative* — Steffen Rasmussen of ABL Engineering discusses the basics of digital video signals, including generating a digital signal from an analog source, coding and decoding, time division multiplexing and some attributes of digital signals. This program explores how digital video can be used in the present and future. (1 hr. 10 min.) Order #T-1067, $45.

☛ *Cable vs. the Telcos* — Will the telephone companies emerge as a major competitor with cable technology in the next two years? Is the end of the cable TV industry just around the corner? Gary Kim (then of Focus Communications) of *Multichannel News*, Steve Wilkerson of Florida Cable Television Association, Gary Moore of Southern Energy Consultants Ltd. and Mark Balmes of Southern Bell discuss these issues from political and economic viewpoints. (1 hr., 20 min.) Order # T-1068, $45.

Note: All videotapes are in color and available in the 1/2-inch VHS format only. They are available in stock and will be delivered approximately three weeks after receipt of order with full payment.

Shipping: Videotapes are shipped UPS. No P.O. boxes, please. SCTE pays surface shipping charges within the continental U.S. only. Orders to Canada or Mexico: Please add $5 (U.S.) for each videotape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface shipping charges (please specify). "Rush" orders: a $15 surcharge will be collected on all such orders. The surcharge and air shipping cost can be charged to a Visa or MasterCard.

To order: All orders must be prepaid. Shipping and handling costs are included in the continental U.S. All prices are in U.S. dollars. SCTE accepts MasterCard and Visa. To qualify for SCTE member prices, a valid SCTE identification number is required or a complete membership application with dues payment must accompany your order. Orders without full and proper payment will be returned. Send orders to: SCTE, 669 Exton Commons, Exton, Pa. 19341 or fax with credit card information to (215) 363-5898.

Reader Service Number 18

SCTE INSTALLER PROGRAM INFORMATION REQUEST CARD

The SCTE Installer Certification Program was created to establish minimum skill requirements for CATV installers and installer/technicians. Participants in the program must successfully complete practical examinations in the areas of cable preparation and meter reading, as well as a written examination on general installation practice. The program is being administered by local SCTE chapters and meeting groups under the guidance of SCTE national headquarters. All candidates for certification in the program are recognized as SCTE members at the Installer level, and receive a copy of the SCTE Installer Manual.

☐ Please send me information and an application for the SCTE Installer Program.

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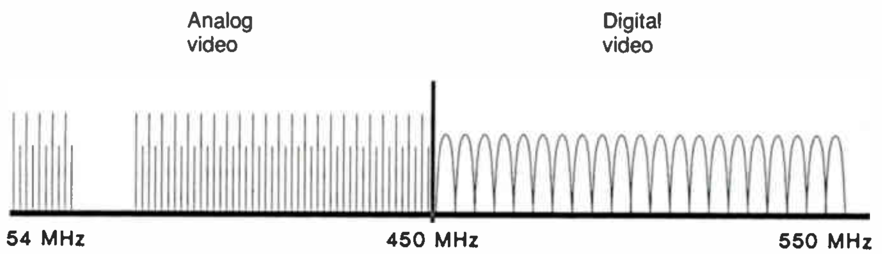
Interdiction: The opportunities, challenges and realities

By John Cochran
Senior Applications Engineer
Subscriber Products Business Division
Scientific-Atlanta Inc.

Figure 1: Interdiction's combined analog/digital capability



- Provides 61 analog channels
- Uses up to 100 MHz to provide digital compressed signals
- Interdiction controls analog video and passes the digital signals

Addressable interdiction has proven itself as an instrument for conditional access of cable TV services. Nearly three years ago, modern interdiction made its first step into a subscriber area in Williamsburg, Va. Since then, more than 15 systems have installed interdiction. Interdiction has survived a Canadian winter with temperatures down to -40°. Also, the existing systems survived 90+° heat, extreme lightning, heavy winds, ice and rain. Interdiction has worked through it all; the majority of operators considered this its most difficult task. Not only has interdiction proven to be better than 98.5 percent reliable, but today it is becoming increasingly apparent that it also has a real role to play as a companion to digitally compressed video.

The opportunities

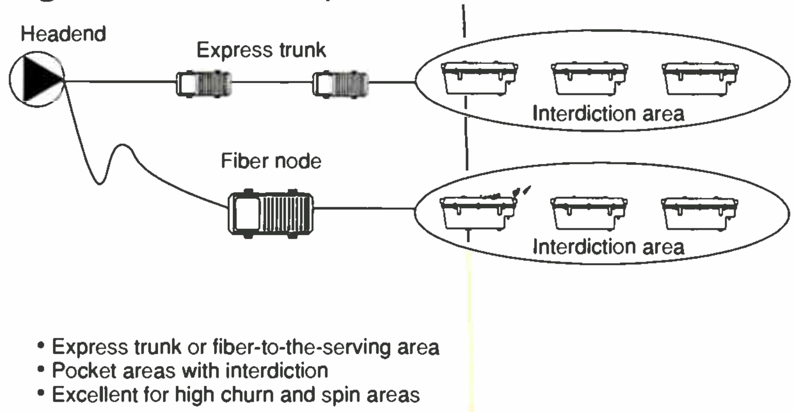
Cable TV is clearly in real competition for the home entertainment dollar. The VCR is a home-ready device that has fueled the demand for in-home movie entertainment. Looking at video rental, it is clear that any entertainment service undertaken by cable TV for the home should be consumer-friendly with programming available on-demand and of sufficient variety. The cable system of the future must provide compatibility for use with today's consumer electronics, allow migration to the next generation of consumer devices, and provide services to the broad masses as well as the niche segments of the market. Interdiction fits this bill better than any addressable technology because it provides an interface to the home that can carry any broadband service to any broadband device.

- *Digital compression-compatible.* Cable TV is currently an analog world, but the direction of the future is toward digital technologies for audio, video, voice and data services. A migration toward digital is likely to occur gradually resulting in the coexistence of analog and digital for a period of time determined by the life of in-home entertainment devices. Conservative estimates place a digital standard at majority penetration in consumer devices in some seven to 10 years. Additionally, new analog TV sets are traditionally 10 years from being replaced. Given that up to 10 years of mixed service will exist, interdiction is the perfect device to accommodate this mix. The current and future control method exists for any analog-formatted service by using jamming security. At the same time, the interdiction device passes any digital or other format of service uninterrupted to the home.

Depending upon final compression ratios achievable, a cable system frequency range of 450 to 550 MHz could accommodate carriage of as many as 200 digital channels. With digital technology, today's cable systems could offer an expanded pay-per-view (PPV) or even near-video-on-demand (NVOD) service. This is cable TV's answer to competition with home video rental. To be home-friendly, this new service must not preclude present service or device compatibility for the masses. The most likely scenario is that NVOD will begin as a niche service. A home terminal is required for digital video compression to the home for decompressing the digital signals and providing compatibility with today's analog TV sets. As illustrated in Figure 1, interdiction passes the compressed video bandwidth above 450 MHz to the home terminal for the niche service while preserving the capability to interdict analog services up to 450 MHz for the mass market.

• *Serving subscribers and non-subscribers*. Subscriber prospects can be marketed by providing a free preview of the cable services for a limited time rather than relying solely upon bill stuffers, newspaper advertisements or other mass media. Homes with an active interdiction interface and drop cable can be instantly installed by addressable control at any time. Limited service to a non-subscriber on a daily or weekly basis has the potential for large revenue and is just beginning to be exploited. The interdiction system is designed to accept a PPV purchase from a non-subscriber on a disconnected drop, provide the event and return to disconnect automatically. This limits the billing system interaction to the traditional credit confirmation and purchase transaction. The present and future incremental revenues available by using the interdiction product are manifested by intensive marketing of the services. Up-front expense for drop installation of non-subscribers and the initial installs of subscribers and non-subscribers should be expected.

Figure 2: Pocket deloyment of interdiction



Therefore, interdiction offers unmatched compatibility to *all* of the latest consumer electronics, provides the architecture for future services and provides the infrastructure to serve the entire market. Interdiction is compatible with cable-ready consumer devices and does not necessitate a home terminal for cable-ready equipment. The interdiction on/off switch is convenient in serving a non-subscriber with NVOD. Any signal, analog or digital, can be passed by interdiction, which makes it "future-ready" for any service.

The challenges

Interdiction has just passed its three-year anniversary in cable service. The three years have seen an excellent performance record in the technological areas considered to be the most critical.

• *Replacing the passive tap*. Interdiction overcame one of its most difficult challenges because it is an active device in the cable system. The interdiction unit replaces the passive tap in the feeder system and the addressable home terminal in the home. Reliability of the passive tap mechanically and electrically is one of the highest of any distribution device. Today's home terminals also are very reliable. With an installed base of more than 40,000 interdiction drops to subscribers, the annualized failure rate of an interdiction port is less than 1.5 percent. This compares to almost 0 percent for the passive tap and a range of 1 to 5 percent for addressable converters.

This annualized failure rate does not take into account nor does it rate the effects of disconnecting and reconnecting of services at the drop. One advantage is that interdiction does not subject the drop cable to the mechanical stresses due to churn. This advantage alone helps eliminate the cause of 30 percent of today's service calls. The combination of interdiction and a more reliable drop cable installation provides more reliable service and less recurring expense than passive taps with drop cable.

• *Power implications*. Interdiction has overcome another tough challenge because it requires AC power from the feeder system. Instinctively, cable operators had envisioned more power and more power supplies as a less reliable system. For two reasons, this has not proven to be the case. One, interdiction has internal surge suppression circuitry. Surge protection is effectively cascaded by installation of interdiction in the feeder system. This has localized the surge effects and allowed the feeder plant as a whole to be more reliable. Second, the design and construction techniques have migrated toward feeder powering. The trend of RF distribution design is toward feeder power with non-standby power supplies in interdiction and fiber node areas. Therefore, reliability increases as a direct result of the lack of batteries in the feeder system power supplies. Indirectly, feeder powering in conventional tree-and-branch coax distribution reduces the surges in the trunk by eliminating the power path from the trunk to the feeder. The distribution system reliability can increase as a result of the distribution architectures required for interdiction. *(Editor's note: On the other side of the coin, if care is not used when designing the AC powering layout, an increase in power supply cascades can occur, which will affect system reliability.)*

• *Operations implications*. Cable operators have become familiar with the requirements of interdiction in the areas of operations, installation and maintenance. One system went from trap control to addressable interdiction with very few difficulties. Operations are affected most by the fact that each interdiction tap port is now an addressable control point in the service. During a build or subsequent connect, the home-to-port information accuracy is essential in providing the proper service level to that drop and assuring disconnect/reconnect capability in the future. Cable operations have been able to capture the interdiction port-to-home connection accurately. The customer service representatives have learned what to listen for and what to say to interdiction customers. The technicians and installers learned how to install, balance, troubleshoot and maintain the interdiction devices. The education process is an essential key to proper operations, installation and maintenance.

• *Billing system adaptations*. The billing systems have adapted in the areas of non-subscriber services and inventory control to allow some of the benefits of interdiction to be realized. Major billing vendors have developed the software drivers written to interface with interdiction's address-

(Continued on page 37)

Designing with interdiction — Part 1

An article was written for "Communications Technology" (October 1991) approximately one year ago that considered the following areas pertinent to interdiction design: basic interdiction concepts, differences in designing with interdiction, interdiction RF design considerations and AC design considerations. This series of articles is intended to take up where the last one ended with an initial examination of how interdiction has changed in the last year, then a further examination along several fronts.

By Mark Bowers
President, CableSoft Engineering Services

Several major manufacturers now offer interdiction product lines with fairly similar features. A tap-like device is placed at the pole or pedestal, with the unit either internal to the system (spliced in replacing the existing multitap) or external to the system and fed via the existing multitap. This tap typically contains a directional coupler, equalizer, broadband amplifier, interdiction oscillators (which can be programmed to interfere with certain channels), power supply, data transceiver, and other active and passive components.

As mentioned, the tap usually contains several oscillators, each of which covers an octave or range of frequencies or channels, all contained within a plug-in module. Because the interdiction tap is addressable, each tap port can be addressed and programmed to pass some channels in the clear, while others are jammed or interfered with. Frequency ranges covered are typically from 54 MHz at the lower frequency end, to around 450 to 600 MHz at the high end; with anywhere from 50 to 72 channels that can be jammed or interdicted.

It is important to note at the onset that the interdiction tap or device is active in nature, as opposed to the passive multitap we are so familiar with and typically employ in current designs. The signals passing through the tap are sampled with a plug-in directional coupler (DC), then fed through an equalizer into a broadband amplifier. After signals are preprocessed via the proper DC, equalizer and amplifier, interdiction oscillator signals are injected within each channel as appropriate and as selected by the operator. Because a broadband device is employed to process the CATV signals, it follows that the interdiction tap contributes to overall system noise and distortion in the signal(s) delivered to the home. Some specifications for a typical interdiction tap are shown in Table 1.

Table 1: Device specifications

Output level (nominal)	+16 dBmV @ 550 MHz
Output tilt (nominal)	6 dB from 54-550 MHz
Noise figure	11 to 12 dB
CTB	-60 dBc
X-MOD	-60 dBc
CSO	-60 dBc
Hum modulation	-65 to -70 dBc
Power passing (Current)	5-8 amperes
Power consumption	8-16 watts, depending on configuration

There are some other differences between interdiction and designing with multitaps that need to be examined and discussed. A typical addressable interdiction unit, besides the other circuitry mentioned, contains automatic gain control (AGC). The unit must maintain a fairly narrow amplitude window between broadband input signals to properly inject the interdicting carriers and maintain optimal jamming interference; hence the careful selection of directional couplers and equalizers. If the interdiction technique is to achieve maximum jamming effectiveness, the relationship in amplitude between picture carriers and jamming carriers must be closely maintained.

This raises another issue, which is "hot taps." Because the interdiction unit has a carefully designed input/output range, hot taps are not possible. This presents an interesting dilemma for the designer. Levels are adequate from the device for a typical design, but the *technique* of higher-than-normal levels fed from a 2-port multitap into a long drop (hot tap) won't work. In many cases, directional couplers will be employed for hot feeds as is done in current designs; use of RG-6 and RG-11 for service drops also must be considered in many areas.

Other differences in designing with interdiction

There are some additional concepts that deviate from normal design considerations and need to be discussed as well. They are: tap equivalency values, tap port efficiency considerations and distortion analysis with the interdiction device.

1) *Tap equivalency values.* A passive multitap comes in 2-, 4- and 8-port configurations; and in manufacturer-assigned values. The overall tap value represents the loss of the device from input to tap port, and includes the built-in directional coupler value plus internal splitting (2-way, 4-way, etc.) losses. If a 4-port 29 dB tap is needed, you just order that value. What you'll receive is (roughly) a unit that internal-

(Continued on page 40)

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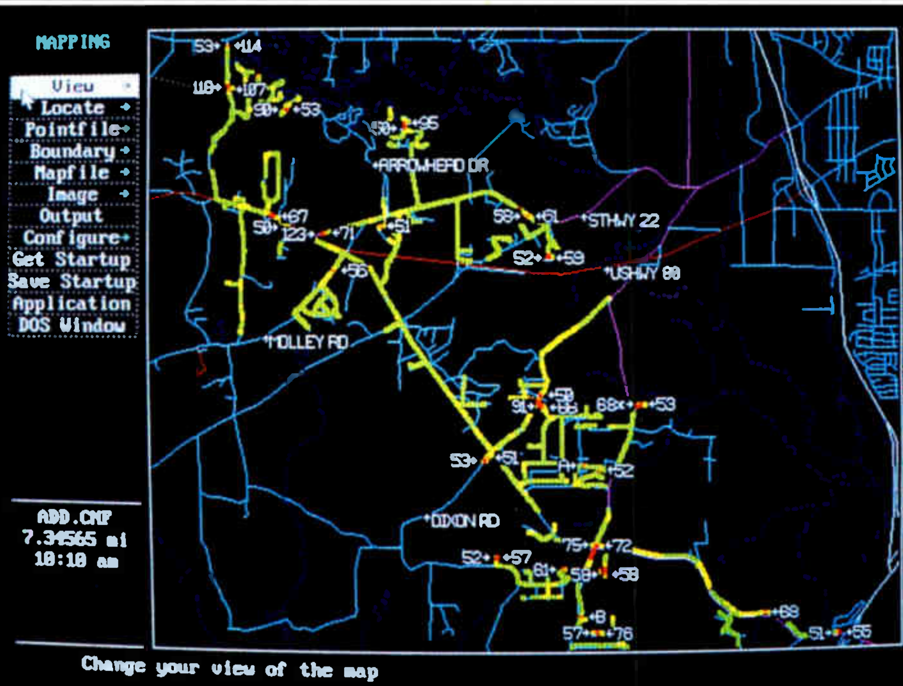

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Interdiction technology in a hospital environment

This article explores the reasons why an interdiction system was chosen for the hospital market, and then gives actual experiences in installing and operating this system.

By Bruce Spengler
President, BGS Inc.
And Jack Matthews
President, COM1

Approximately two years ago, COM1's management determined that an opportunity existed to provide a comprehensive package of pay-per-day cable TV programming to hospital patients who were generally able to receive only local, off-air signals (and with poor reception at that). Associated with this opportunity, however, were several unique challenges; they included:

1) The intensive level of patient service required by hospitals.

2) The nature and demographics of the potential customers.

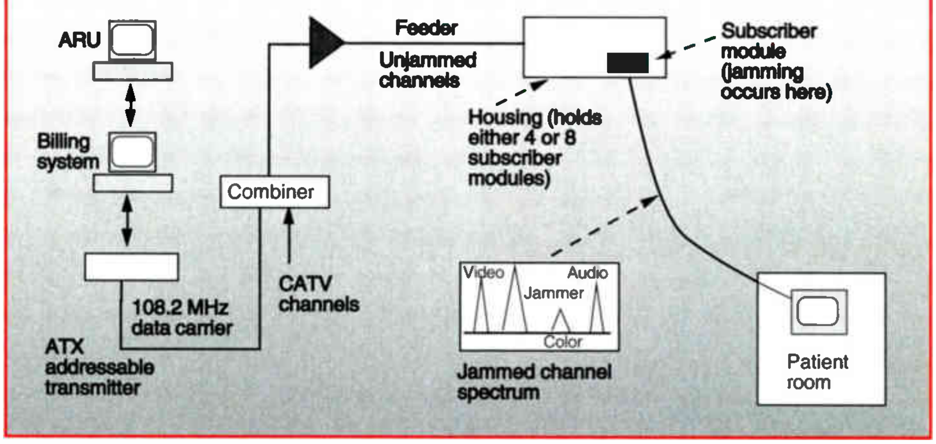
3) The need for a flexible, customized pay-per-day billing system.

4) The restrictions inherent in introducing electronic equipment into the hospital environment.

Items 1 and 2 require that COM1 go to great lengths to inform and educate patients as to the operation of the cable system as well as to provide on-site customer service and an easy-to-use automated response unit (ARU) for automated ordering. Items 3 and 4 are related in that an interface between the billing system and the addressable technology was required. Working with Computer Utilities of the Ozarks, the pay-per-day billing system was developed. To overcome the difficulties associated with the electronics issue, the Scientific-Atlanta interdiction system was chosen. S-A and Computer Utilities then developed an interface that allows the billing system to control the interdiction equipment without the need for an S-A System Manager.

In addition to the customized billing system, COM1 also developed an ARU to provide an automated order entry process. This ARU also allows a full range of voice processing services to be offered, including voice mail, automated attendant, predictive dialer, fax-on-demand and interactive voice response.

Figure 1: Interdiction system



BGS Inc. was enlisted for design and project management services for the system, which was installed at Baptist Hospital in Pensacola, Fla. It has been operational since March 1992.

Interdiction vs. converters

Let's take a look at the similarities and differences between the interdiction and the converter systems. Interdiction uses jamming carriers to prevent channels from reaching the viewer. (See Figure 1.) These jamming carriers are generated in the interdiction unit at each "tap" location. In other words, this system *interdicts* the clear signal to prevent it from reaching the viewer in a recognizable form. In contrast, set-top converters rely on scrambled signals that must be reconstructed in the converter in order for the viewer to receive the signal. Therefore, the result is that you get better picture quality with interdiction because the signal is not processed.

The interdiction modules, or subscriber modules as they are called, are installed in either 4- or 8-port housings. These housings also contain a power supply that uses line power and changes it to a DC voltage to supply power for the electronics. Each housing has both a directional coupler and an equalizer module to send the RF signal to the interdiction modules. Each module controls one drop, so that a fully loaded 4-port housing can service four drop locations. The subscriber modules are controlled by a dowstream data signal at 108.2 MHz, which is generated by an addressable transmitter (ATX).

One of the benefits (and drawbacks) of the interdiction system is that each module has an AGC section that gives a constant and known output to the drop port. (See Figure 2 on page 43.) Of course, system levels have to be within the input range of the AGC. This is done by carefully choosing directional coupler and equalizer values for each housing. This can be tricky and, in spite of abundant charts and programs available to help get you close, on-site testing and changes are often required.

Hospital considerations

All of the advantages mentioned previously apply to any cable system. In our case, the interdiction system provided special advantages that are unique to the hospital environment.

The first advantage derives from the fact that no equipment is required in the patient room. Special UL rules apply to any electronic equipment placed in a patient's room, and there are no off-the-shelf converters that meet these requirements. The few proprietary converters designed for the hospital market are quite expensive and raise significant concerns about single source suppliers.

Second, a normal patient room uses what is known as a pillow speaker to change channels, control volume and to listen to the audio (in addition to serving as a nurse call system). A converter's remote control adds an additional, con-

(Continued on page 43)

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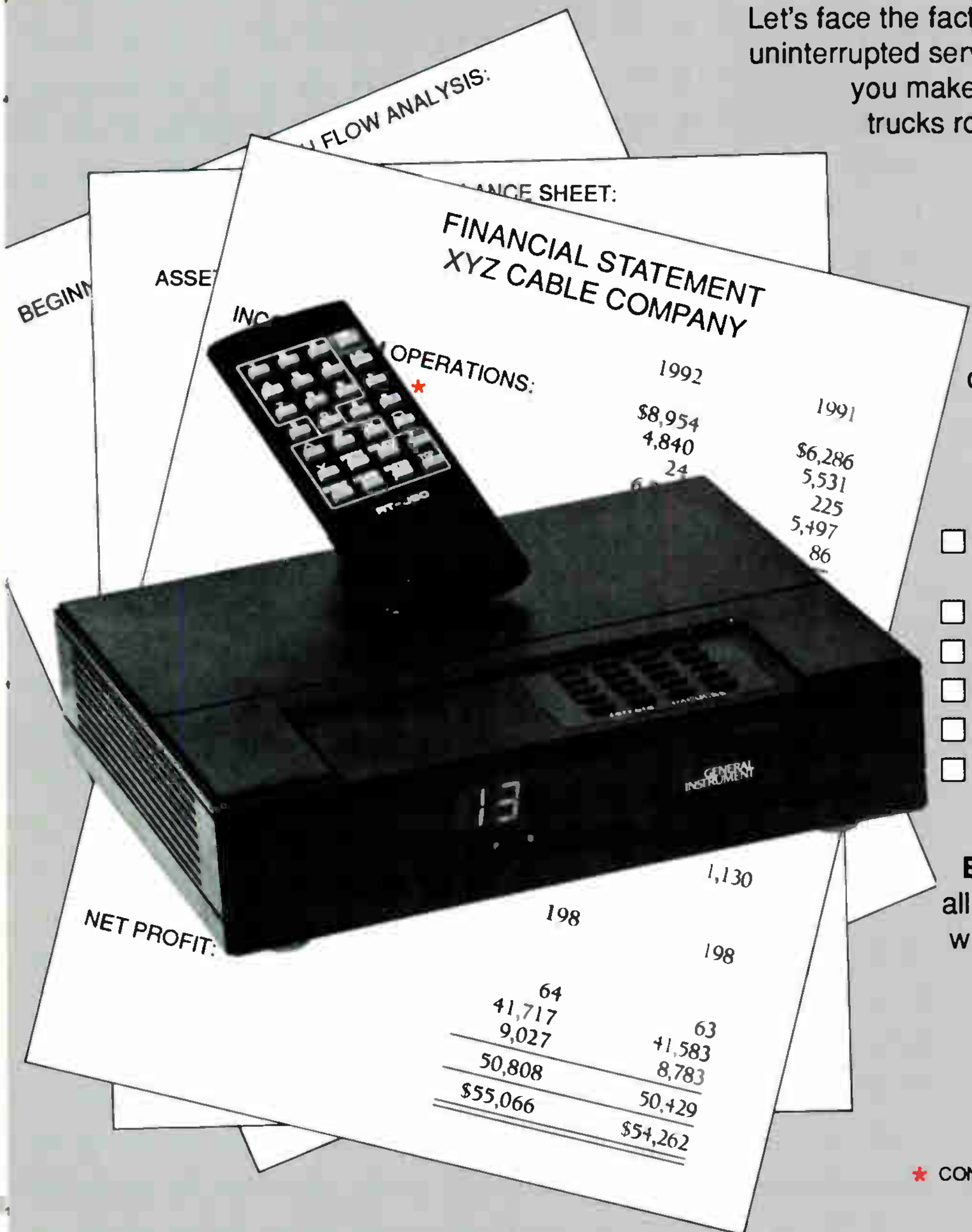

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Interdiction and the sub management system

By Ed Alspaugh
Sales and Marketing Manager
Computer Utilities of the Ozarks

If I were an average cable subscriber, I would have a cable-compatible TV set, cable-compatible VCR, set-top cable descrambler and a remote control for each. It's frustrating for some subscribers to rewire their video equipment just so they can use their video recorder. It doesn't make sense that they would have a cable-compatible set with remote control and not be able to use it. Does it have to be like this? No, it doesn't!

Interdiction can provide the service delivery flexibility needed by the cable operator and the user-friendliness demanded by today's consumer. Some benefits interdiction offers the subscribers are: they don't have a descrambler in their home, they use their factory remote controls and they continue to have pay-per-view (PPV) programming available. Some benefits interdiction offers the cable operator are: lower monthly operating costs (*Editor's note: except perhaps for system powering*), improved subscriber marketing flexibility, service delivery security and less complicated subscriber training. Another benefit interdiction can provide is the ability to offer stand-alone (e.g., PPV, weekend service) programming to non-subscribers.

Adapting to change

Implementing interdiction requires some changes in traditional subscriber management billing system philosophies. For example, providing program access to non-subs would mean the subscriber management system would have to allow service without basic service and provide a one-time bill. Also, the interdiction port addresses, which are synonymous with descrambler addresses, must be logically linked to the service delivery location. These changes alter the traditional converter data base relationship. As well, because the interdiction port addresses are assigned in contiguous blocks, you would never have Port 1 in a truck and Ports 2 and 3 in the warehouse. The subscriber management system must adapt to track interdiction module address ranges as inseparable blocks, the status of the module itself and the status of the port module slot(s) as populated or unpopulated. Of course, we still need to track the module's plant location by map, pole or other coordinates.

A simplified subscriber management system in a converter or trap system might consist of the location, subscriber and converter data bases. We would assign the subscriber to the location and, depending on the system, the converter(s) to the house or possibly to the subscriber (which means if the subscriber moves, the converter follows).

A simplified subscriber management system in an interdiction system might consist of just the location and subscriber data bases. Again, we would assign the subscriber to the location but the location data base would contain one or more interdiction port addresses (converter address equivalents) that have been wired at the location. The port address would not follow the subscriber. The system should accommodate billing for the active subscriber data base and non-subscribers who wish to purchase just PPV services.

To simplify and enhance outage support, the subscriber management system must be able to select homes by port address or module block/range. A module failure outage could affect from one to 16 port addresses or different homes depending on the type of failure and interdiction system used. The subscriber management system should assist the CSR to isolate the defective module, homes affected, its location within the plant, and allow for module block/range account outage adjustments. Additionally, any features such as tamper detect or single address refresh should be supported and accessible by the CSR to simplify field troubleshooting and module replacement. Outage statistics also should relate to the module block/range to assist maintenance management.

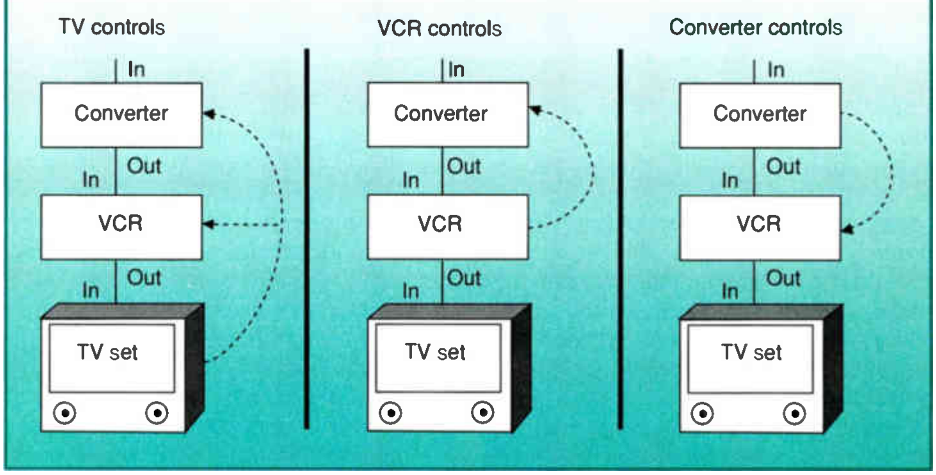
Conclusion

The subscriber management system of this and the next decade must continue to mature with the cable operator and subscriber. Operators will need data analysis tools that are readily available across hardware and software platforms to manipulate their subscriber and demographic data to help increase penetration. Along with some studies showing increases in basic and pay penetration in cable systems using interdiction, it also is an effective method of capitalizing on prospective pay-per-view revenues within the subscriber and non-subscriber base. With interdiction, cable operators can shift some of their focus from operational issues like disconnect or reconnect truck rolls to marketing. To assist the operators' marketing efforts, and make best use of the tiering and unbundling capabilities possible with interdiction, the subscriber management system must accommodate many possible service combinations and employ an open architecture that adapts easily to industry change. **CT**

The future of addressability

By Barry Hardek
Product Manager, Cable Products Division
Zenith Electronics Corp.

Interconnected recording scenarios



Picture this: Sara Subscriber awakens in the morning, pours a cup of coffee and turns on her cable converter. She "speed dials" directly to weather information. "Hmm, looks like rain today. Better bring my umbrella to work." Minutes later Sam Subscriber enters the family room and turns on his favorite morning show. A commercial about the new Venus car is shown with a prompt asking Sam if he would like more information. Sam replies that he would by pressing a button on his remote control, knowing that he will receive an information packet in tomorrow's mail. Sara and Sam depart for work as Grandma makes breakfast for the children. "Sorry we can't spend the day with you Gram," say Sara and Sam. "Don't worry, I'll keep busy," replies Grandma.

When the children leave for school, Grandma turns on her favorite game show, *The Triangle of Treasure*. Using her remote, she plays along at home. "Hooray, I've won!" she says, as she correctly answers the last question. She then removes the smart card from her converter and drives down to the local redemption center to collect her prize. After inserting Grandma's card into the reader, the counter agent says, "Congratulations, you've won a new 13-inch color TV set."

When Grandma returns home, she notices in the newspaper's TV listing that there is a program on arthritis on The Medical Channel. Because she's not familiar with the local cable system, she doesn't know which channel number it's on, but by entering "*-M-E-D" on the remote she automatically tunes to the proper channel.

Later that day, Sam comes home and goes to his converter and checks his stock quotes. He then scans an electronic guide to see what sports programs are on for the evening. During halftime, Sara checks the movie listings and discovers that one she's been waiting to see will be on at midnight. She presses the "Timer" button on her remote control and puts a blank tape into her VCR to record the movie, knowing that the converter will take care of the rest — even controlling the VCR!

While Sam and Sara sleep, your friendly cable operator is tabulating the results of polling decoders for viewing patterns throughout the day. The results of this cable viewership data base are then sent to the marketing department, which uses the data to analyze the programming lineup, to set pricing strategies and so on.

Sound like another futuristic technology scenario? It's not! Converters capable of delivering nearly all of these features and more will be available late this year. And, although most of the advanced features of these decoders have been offered on selected products in the past, a broader acceptance of these decoders is anticipated based on technological advances and lower costs, along with the available software that will automatically support the system features.

"Real-time interactive systems will play an increasingly important role in the future of addressability."

Data-driven equipment

This latest generation of addressable decoder systems will add more data processing and display capabilities than previous addressable products. There are several devices in the home that are concurrently moving toward articulating these same features. TV and VCR technologies also are moving toward the integration of data services with their basic functionality. Does this mean that we are heading down "redundancy row" again as we did with the cable-ready tuner? The answer, to some extent, is yes, but to a much lesser degree than in the past. Data-driven TV sets, VCRs and cable converters will coexist more readily in the future since each has its own unique benefit. Table 1 on page 45 summarizes the advantages

(Continued on page 45)

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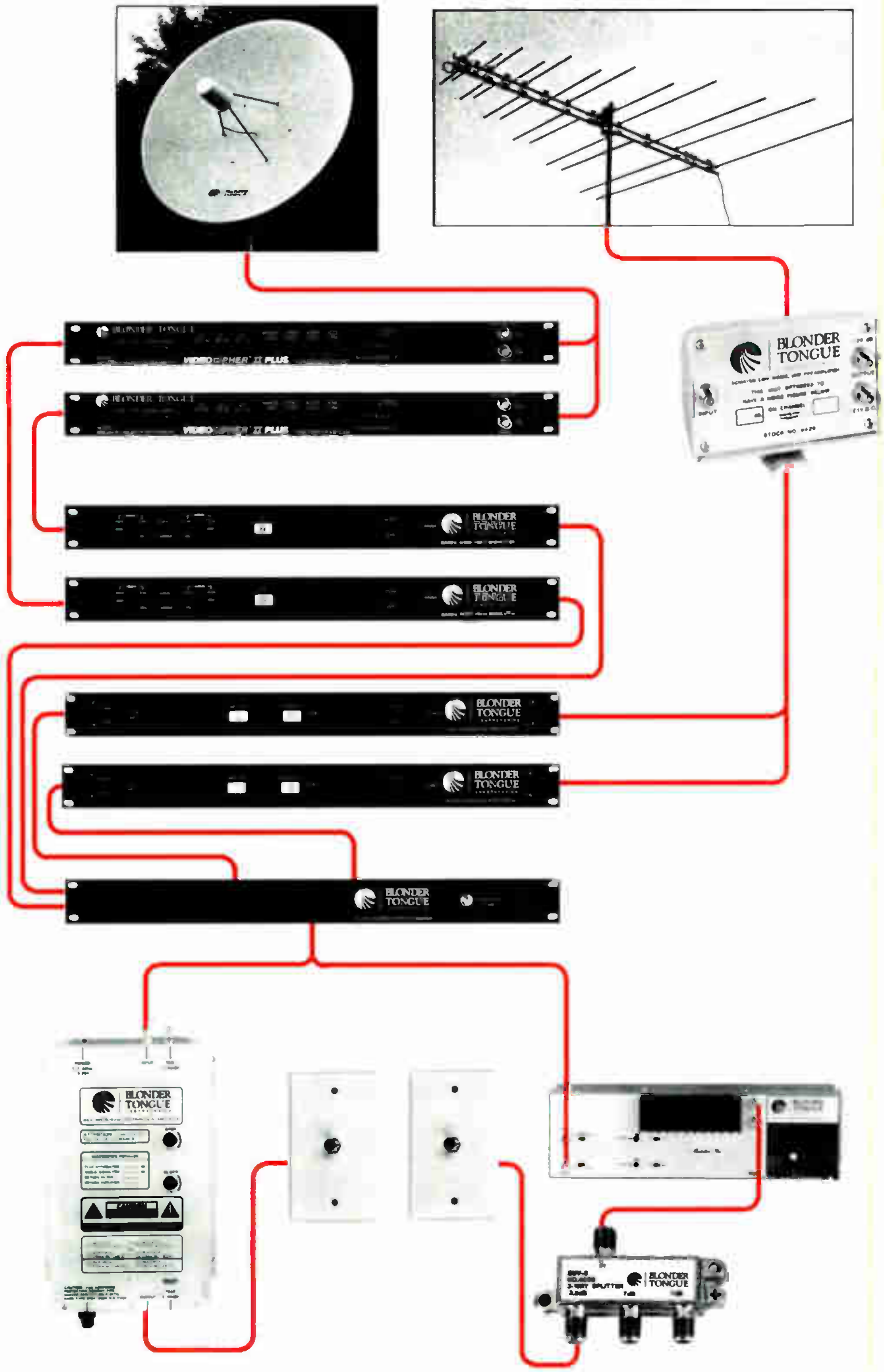

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Reader Service Number 24

"Laser-aimed" training (an alternative to "spray and pray")

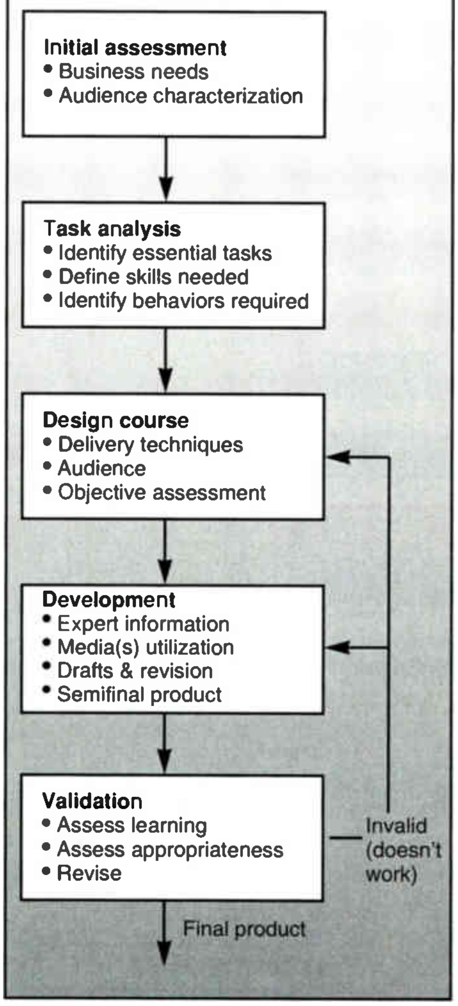
This article provides an overview of the professional instructional system development training format and its implementation in one of Cox's progressive systems. Despite the fact that the program has only recently launched, the business, customer and employee results have been excellent. It has yielded the best results of any technical training program tried by Cox.

By Paul R. Workman
Director of Technical Services
Cox Cable Communications
And Kevin Haynes
Plant Operations Manager
And Jim Palinkas
Technical Trainer
Cox Cable Cleveland Area

What managers want from training is competent employees who can address the business requirement — immediately! What they too often get is less than or none of that, even though substantial money and time was spent. The "spray and pray" approach of sending employees through the usual gauntlet of basic electronics, correspondence courses and home-brew training has not yielded desired results. A "new" approach is in order.

Many training approaches can be compared to "carpet bombing": It often took multiple missions at huge expense to accomplish the task, if at all. Instructional system development (ISD) is a modern training approach and can be to training what laser-guided bombs are to carpet bombing. That is, a very efficient way to attack the issue. Moreover, this ISD process appeals to the sense of logic that most technical managers appreciate. The results have been characterized by near-immediate improvements in business-related needs as well as employee relations.

Figure 1: ISD process



Public education format — inappropriate?

The broad and abstract format of public education is a poor fit in most skill-based applications, although it serves very well for its intended global purpose. As a result of being brought up in the public education format, many of us naturally revert to it as the format for technical training too. This is evident in the broad and abstract approach used in many courses available to the CATV industry. In particular, you can often find course materials that tend to be global in nature or based on a collection of general (topic-related) technical articles. These programs often have no tangible results, applicable skills or specific behavior expected after the trainee completes the program.

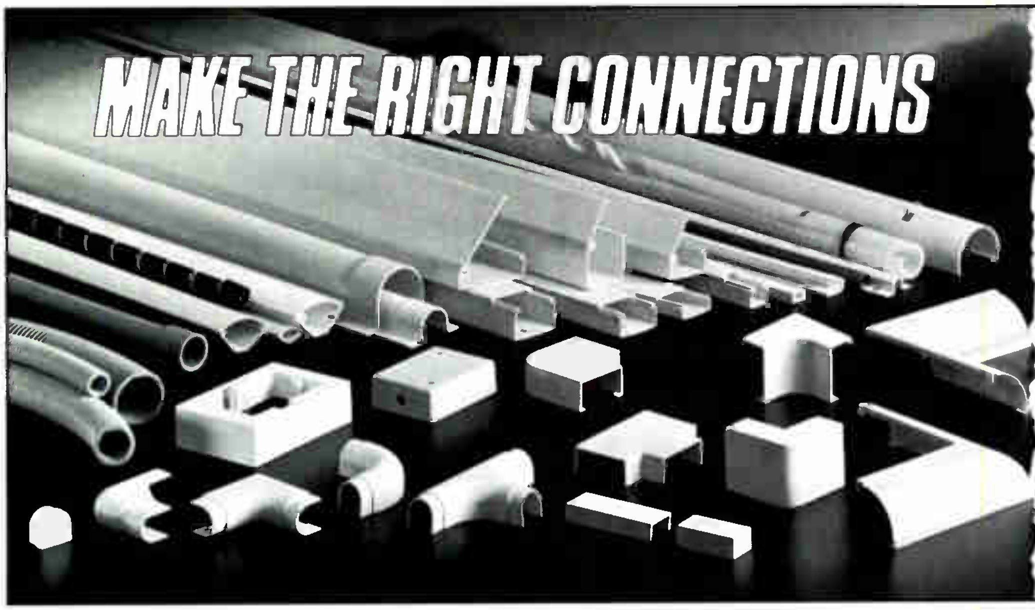
Another fact making the broad "nice to know" approach less effective is that adults do not learn in the same way as children. Children's and adolescents' learning appetites are like sponges: They soak up anything and everything that comes their way and sort it out later. In contrast, adults are more selective. "You can't teach an old dog new tricks" has a ring of truth for people too. Adults need a reason to learn something. Adults ask themselves, "Why am I learning this and how is it going to help me?" Adults will "filter" out information they feel is not important — and that is dangerous. How does any student know what information is or is not important? If you "spray" the adult with both essential and non-essential information, how can you be sure he/she does not filter out the "good stuff"? If learning is to be maximized, the reasons for learning something must first be understood by the adult learner. The information that follows must clearly support that reason or the risk exists that will it be filtered out.

Training for results

The answer to the training technique dilemma may be the "competency-based" methodology, originally developed by the U.S. military and widely used today both by the military and the private sector. Basically, it features the identification of the specific tasks and behaviors required, developing the skills supporting the tasks, and developing the tools to assess and reinforce the training.

One of the commercial versions of competency training, referred to by industry and college course catalogs, is instructional systems development. ISD is essentially a template that is expertly laid over the training needs, capturing and delivering the information and skills essential to a particular job. The beauty of it is the simplicity in which the process isolates the fundamental elements needed to be trained, and pro-

(Continued on page 66)



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System engineering managers: Facing challenges of change

By John Brouse
Manager
Advanced Applications and Network Engineering
Jones Intercable Inc.

Since its inception, the cable TV industry has been constantly changing; more precisely, it has been continually evolving. It has gone from the homemade amplifier in a tuna fish can to sophisticated, high gain, signal level controlled, two-way devices built into an environmentally protected, RF shielded, convectional cooled, well-engineered diecast housing. As well, it is now deploying fiber as the primary delivery vehicle. The tree-and-branch topology of the past is giving way to ring and star hybrids. Soon, the centralized architecture will shift toward distributed networks as intelligence moves closer to the customer. The 12-channel system providing primarily local broadcast TV programming has expanded by an order of magnitude and relies largely on satellite delivery for programming needs. The pressure tap is a much faded memory; interdiction taps are now in the field.

And through it all, our system engineering managers have kept pace. But the winds of change now sweeping through our economy will challenge these managers (and our entire industry) as never before.

A strategic viewpoint

The technology advances mentioned previously, along with many others, have been central to our industry's current-day financial success. These areas of advancement have occurred mainly to address local, technical issues and have resulted in our tactical deployment of technology.

We are now faced with a multitude of long-term, strategic issues that require the blending of new technologies, unconventional approaches to technical operations management, a shift toward the global perspective, and an integrated approach to problem solving. The major concerns affecting our industry's continued success are "Work Force 2000," the era of open competition, and the transition of our national economic base from durable goods production to information and services. Only when these concerns are acknowledged can appropriate methods for addressing them be developed.

"The forces driving our future ... will require a strategic viewpoint, competitive thinking, external focusing and inclusion of 'outside' professionals."

Rather than expounding on the details of the emerging work force, competition and the new economy, suffice it to say that the CATV industry's future will be determined by its ability to become a highly competitive force in the open marketplace. Herein lie the challenges for the system engineering manager.

As suggested recently, network telemetry and control (NT&C) will be a key component in developing a more competitive position. (See *CT*, July 1992, page 26.) NT&C begins to address the three main concerns outlined before. The system engineer will be challenged to develop alternative technical work force operating procedures that take advantage of NT&C's attributes. An accompanying change in manpower requirements and a shift from a demand to a scheduled maintenance philosophy also will be needed as NT&C systems are deployed.

The accelerated deployment of fiber-optic technology can position a cable operator to take advantage of other revenue streams such as competitive access or enhance advertising revenues through market segmentation while simultaneously attacking current reliability and picture quality problems. The system engineer must therefore be sensitive to designs that are driven more by marketing and future businesses than near-term engineering efficiencies. This requires an improved understanding of demographics and non-traditional business opportunities, as well as involving the marketing department at the initial project planning stage. It further requires a view beyond the system level, necessitates approaching system design from the network perspective, and mandates connectivity with the outside world. Hence, foreign technical standards will need to be adopted and maintained.

The challenge of competitive thinking

The real key to becoming competitive, however, will not be technology but the ability and courage to challenge convention. As an example, study the current arrangement for hiring and promoting the technical work force.

The typical entry-level technical position is one that involves the following tasks and skills:

- Representing the company with the first face-to-face customer contact with the customer.
- Acquiring a working knowledge of a myriad of customer-owned devices.
- Making a maximum impact on the amount of revenue generated from an individual customer.
- Developing the ability to be self-supervising.

Sometimes the work of the entry-level position may require follow-up work by higher level technicians. This entry-level position is *installer.*

Advancement generally follows to a position requiring less product knowledge, lower customer contact and decreased impact on revenues generated from an individual subscriber. This next position is the *service technician.*

The third level of advancement requires essentially no customer contact or product knowledge (which equates to minimal impact on the revenue potential from an individual customer), in-depth knowledge of a limited number of system devices and has a fairly predictable workload. This third-level position is *maintenance technician.*

Certainly the highly experienced installer may have the opportunity to move into an installation supervisor position just as an experienced service or maintenance technician would be able to advance to a supervisory position over their respective co-workers. Now ask the question: "Why?" The answer: "That's the way we've always done it." In a competitive world, that answer is not sufficient. To help the system's general manager develop a more competitive approach to today's core business, the system engineering manager should take a critical look at the technical work force structure.

First, rather than examining the various tasks and how many technicians are required in the different areas, it is important to fully examine the individual technician with respect to skills, motivation, authority and contribution to the system's bottom line. Following that, it becomes important to define the skill requirements of a particular position and match the individual to that position. The final step is to determine the workload, the associated technicians' productivity and the resultant manpower requirements for budgeting.

Technical personnel progression

Let's begin with the entry-level position. The new technician generally lacks a track record in either the industry or company, has little or no technical training or experience, usually possesses poor interpersonal skills and thinks in terms of a job not a career. With this background in mind, management's primary objective should be to develop a long-term highly productive technical associate. Achieving this requires close supervision for an extended period, limited in-depth technical training (both theoretical and hands-on), education regarding the industry in general with company specifics, insulation from negative outside influences, and continual feedback.

In essence, management needs to provide a nurturing work environment. The question now becomes: "What position carries skill requirements that accommodates this individual?" Let's now define the requirements of a position titled Service Technician Level I and assume the responsibilities of that position are limited to scheduled trunk maintenance only. This position would require a fundamental understanding of the primary transport system (the trunking network), signals being transported, map reading, basic performance standards and testing procedures, use of test equipment and maintenance documentation. Since this position could significantly affect a large number of customers at one time, close supervision is required as well as follow-up inspection of the work completed. Requirements of this position are directly in line with management's goals for developing an entry-level technician.

After mastering an entry-level position, the technician has gained some insight into the company and cable industry, achieved some degree of technical competence, demonstrated an acceptable level of motivation, and has begun learning about the product. Management's primary objects should emphasize continued technical training, reduced supervisory requirements and continued insulation from negative outside influences. Let's assume the natural progression for the technician is to Service Technician Level II. The responsibilities of this position include maintenance on the primary and secondary transport system (the trunk and feeder networks). This position requires the skills of Service Technician Level I plus an understanding of the feeder system, system powering, system troubleshooting and repair, fundamental construction practices, use of additional test equipment, and reduced supervision. Again, the requirements for the position and management's goals for technician development are in agreement.

The next progression would be to Service Technician Level III. The tech now becomes responsible for individual customer-related demand maintenance (somewhat comparable to today's service tech). At this point the technician has a well-formed technical understanding of the cable delivery system and performance criteria, good product knowledge and has developed the basis for self-management.

Management's goals for further developing this individual include continued technical education, further reduction in supervisory requirements and introduction to the customer/technician interaction. Service Technician Level III position requirements expand on those for Level II by adding knowledge of the drop system and consumer-interface devices, developing better interpersonal skills, understanding and using the subscriber billing system, and reducing supervision to minimal. Because the technician has the requisite knowledge for maintaining and repairing the trunk and feeder portions of the plant, authority is given to fully resolve the customer's problem without resorting to a higher level technician. Again, the position and individual are compatible.

The last move up the service technician hierarchy is to Service Technician Level IV. At this point the Level III tech has mastered all phases of the transport and distribution system, has a thorough knowledge of the product, has developed an acceptable level of interpersonal skills, gained insight into the customer-owned equipment, demonstrated a high level of motivation and an acceptable degree of self-management, and become fully integrated into the company. Management's goals for this technician are to develop a strong sense of commitment to bottom-line improvements through on-premises sales and retention skills.

Service Technician Level IVs have the responsibility for initial installation of services and are given authority to effect repairs on any portion of the plant so that no additional work is required following completion of an installation. Requirements for this position include all those for Level III, sales and retention skills, and the ability to self-manage. Here too, management goals and technician skill levels are consistent. Once the service tech has been successfully working at Level IV and is looking for advancement, suggested positions that become available and take advantage of the skills gained could include technical supervision (qualified to supervise any of the four levels), outside sales (which could mean instant installs become the norm), headend technician and the like.

As should be readily apparent, this technical personnel development scheme can not be effected quickly; it would take time to develop and deploy. But, the potential rewards are dramatic. This kind of scheme then is more strategic than tactical and requires a long-term vision and goal. The important issue here is not that this is the right direction for technical personnel development, but rather that the system engineering manager must think outside the conventional box so that a competitive edge can be honed. Competitive thinking also challenges the engineer to forecast future requirements that could be integrated with current plans such that migration strategies that maximize the benefits of capital outlays can be developed. As an example, it has been shown that a now traditional deployment of fiber technology to service the residential video entertainment business could be modified to incorporate competitive access require-

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System technical management

By James A. Goins
Plant Manager, United Artists Cable of Florida

The scope of technical management in a cable system is largely dependent on the size of the system and the organizational structure of the company. However, the focus of technical management is independent of these same variables. The focus has to be on using all the resources on hand to deliver the very best product to the subscriber. The ability to consistently maintain this focus is the attribute that makes an organizational professional and is indicative of superior technical management.

Some titles of system technical management professionals are chief technician, technical manager, plant manager, chief engineer and director of engineering. The term of technical manager as used in this article represents all technical management professionals. Most cable system technical managers have the responsibility to build and maintain the cable plant and oversee the upkeep of all the associated hardware needed to deliver quality signals to subscribers. The following areas are typical of the scope of responsibility assigned to a technical manager:

- Emergency maintenance
- Installation of service drops
- Preventative maintenance (PM)
- Headend maintenance
- Bench repair
- Warehousing and purchasing
- Expansion (new-build)
- Technical training
- Self-improvement and continuing education
- Selecting and motivating technical personnel

Emergency maintenance is a top priority in cable systems. Keeping quality pictures on all subscribers' TV sets is a top-priority task in technical management. Service technicians are usually the first technical persons to respond to picture problems on a cable subscriber's TV set. The majority of such problems are solved by repairing some defect in the service drop, the drop connectors or the converter box. With the proliferation of connections of subscriber-owned equipment to the cable drop inside the home, subscriber-generated service requests have increased proportionately. The technical manager is often an arbiter of technical misunderstandings between service technicians and the subscribers wishing to speak to a higher technical authority.

Installations must be completed soon after the customer orders service. Experience shows if a customer is connected to the cable within three days after placing the order, the customer will have the perception of a responsive cable TV provider. If in-house personnel are unable to keep up with the workload within the three-day time frame, the technical manager will have to use contract installation personnel on a temporary basis to complete all installation work within the goal time frame as specified by the general manager. During the short visit in the home, the installation personnel must fully educate the subscriber as to what to expect on each channel. Final customer instruction on the use of cable-supplied equipment such as converters, A/B switches or stereo tuners has to be completed at this time.

If the installers fail to do a thorough job during this customer education process, a service call will be placed within the next 30 days, the customer will disconnect, or the customer will remain unhappy because all services supplied by the cable company are not used or understood. In this event, the cable company loses revenue and customer goodwill. Extensive training of the installation staff is the only solution to this problem. The technical manager must take a lead in assuring that installers are fully qualified in customer relations as well as the mechanical portion of the installation process.

"A dedicated program of correspondence courses, Society of Cable Television Engineers seminar attendance and in-house training often achieves satisfactory technical growth within the staff."

Maintenance and repair

Preventive maintenance of the cable plant is a very important area of technical responsibility. Lack of PM does not show up right away. Sometimes problems are not readily apparent, such as when a small increase in service calls is not correlated to a lack of maintenance. Conversely, the beginning of a good preventive program does not show immediate results in decreased service calls or customers calling to express pleasure at the higher quality pictures. Because of this delayed response following PM or lack of it, it is often easy to make a decision to put off the task. All technical managers face this decision on a daily basis.

Headend maintenance is an ongoing challenge. Maintaining and adjusting receiving equipment for the reception of TV signals, other RF signals and data is only a part of the work that goes on in the headend. The use of multiple TVRO earth station receiving antennas is a common occurrence today. Keeping up with the programming moves from one satellite to another is a continuing challenge. Processing equipment requires expertise in video, audio, data and RF circuits. Technicians are often permanently stationed in large system headends. In smaller systems, a maintenance technician or the chief technician may perform all necessary headend maintenance. The technical manager needs to have expertise in the headend area in order to properly plan future needs and respond to changing program sources.

Documentation is required to satisfy the Federal Communications Commission and the franchise authority. Maintaining proper documentation also assists in decision making and in maintenance. The technical manager must have reliable headend technical personnel to ensure the system does not violate any rules or procedures that will jeopardize the operational authority of the cable system or subject the system to large fines.

Bench repair is responsible for converter repair, plant amplifier checkout and repair, test equipment checkout and repair, and repair of any other me-

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Color signals: FCC-required measurements

By Jeff Noah
Technical Writer, Tektronix Inc.

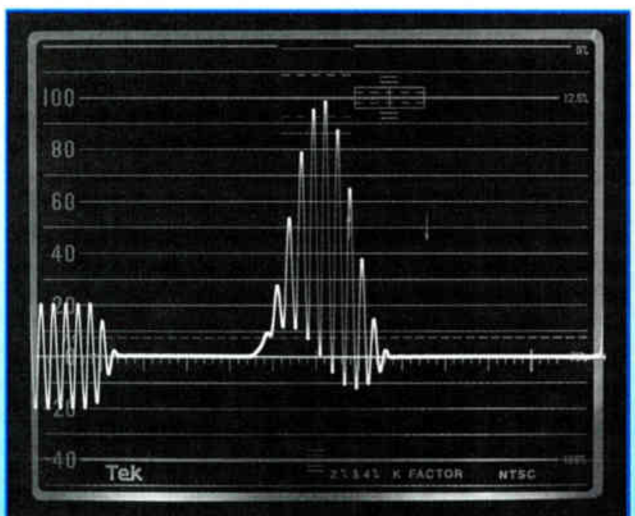
The following is the second in a four-part series of articles that began last month on Federal Communications Commission-required measurements for cable TV. This second article discusses the requirements for chrominance-to-luminance delay, differential gain and differential phase.

Of all the measurements required by the new regulations, the three color signal measurements (differential gain, differential phase and chrominance-to-luminance delay) are probably the least familiar to cable operators. But don't worry. The measurements are fairly easy to perform and the details of the regulations are not at all burdensome, especially in comparison to the RF level measurements.

The measurement limits specified, for example, are easy to meet (even though, ideally, operators should strive to exceed the specs to ensure the best possible picture quality). Because tests are performed at the headend, you don't have to drag multiple pieces of test gear out to several field locations or up a pole, so equipment management is relatively simple. Scheduling these baseband measurements is simple as well, since the mandatory interval is once every three years. And you're directed to make the measurements on only four channels (plus one additional channel for every 100 MHz upper frequency limit above 100 MHz).

There are some questions about the specific measurement methods called out by the FCC and what methods might be accepted in their place. This article discusses those issues, but focuses on industry-standard measurement techniques that fulfill the spirit of the regulations — to provide an acceptable quality video signal to subscribers.

Figure 1



A sinusoidal distortion in the base of the 12.5T mod pulse indicates chrominance-to-luminance delay. In this example chrominance is delayed by approximately 250 ns.

The issues

Before actually discussing the "how to" of the measurements, we need to spend some time discussing a few of the unresolved issues surrounding them. To start with, we've been told to make the measurements at the output of the headend. No problem — just hook up the tunable precision demod (through a directional coupler) at the output of the combiner, use the line select feature on your waveform monitor/vectorscope to look at an appropriate vertical interval test signal (VITS), and make the measurements.

It should be this simple. But what about this VITS signal, anyway? Should the measurements be made on VITS embedded in the signals you receive, or should you insert new, clean VITS prior to modulating/combining? In the case of satellite signals, inserting VITS would be relatively easy because satellite receivers typically convert signals to baseband. For off-air signals, more equipment (in addition to the usual headend processing gear) would be required to get these signals to baseband for VITS insertion.

The new Paragraph j of Section 76.609 ("Measurements") says that the color signal measurements are to be made in accordance with the 1989 NCTA-recommended practices. These procedures, however, do not utilize VITS for on-air testing. Instead, they call out a measurement process that requires you take a channel off-line to perform the tests — not a very practical method in these days of round-the-clock programming. There is an NCTA working group whose charter is to look at the recommended practices in light of the new FCC regulations and revise them as needed.

Assuming some type of on-line testing procedures that use VITS will be allowed or approved, let's forge ahead and explore some more points to consider before performing the color signal measurements.

The new regulations state that when it comes to signals outside the limits of the regs, "cable operators are not expected to improve upon the signals they receive." What if a given signal is near the edge of the spec, and the minor amount of distortion added by your system puts the signal over the limit?

One tempting solution to these issues is picking only signals (channels) that already have VITS and very low distortion. Since you're required to measure only four channels (plus a few more depending on upper band limit), this would be an easy way out — or would it? Let's discuss the potential for disaster.

Suppose for a moment your system has only 25 channels and your upper band limit is such that you're required to measure only four. You make the measurements on clean satellite signals, document the measurements as required, and then file them away. You've met the requirements — or so you think. Someone comes home from a bad day at the office, flips on the tube and the first thing he notices is smeared colors on his favorite old movie. He calls his neighbor, who's on the city council, and complains. The city council hires a contractor to do a performance audit of your cable system. Which four channels do you think the contractor will select for measurement? The same four "golden" channels you selected? Not likely.

The FCC regulations say you must meet these requirements on all channels, but that you do the proof-of-performance testing on a set number of channels determined by your system's parameters. At some point you'd better test all channels to make sure they comply.

More about VITS

By inserting a test signal on a single line in the vertical interval rather than transmitting a full-field test signal, you can conduct a wide variety of baseband measurements without interrupting regular programming. All it takes is a VITS inserter.

A VITS inserter is a baseband device that adds test signals to specific lines in the vertical interval of the program material. The test signals that inserters offer vary from model to model, but combination signals designed for transmission system tests are always available. The color signal measurements we'll be discussing require two different test signal elements, the 12.5T modulated pulse and the modulated staircase. Both are found on two of the most common VITS signals, NTC 7 Composite and FCC Composite.

Viewing (and measuring) VITS calls for a waveform monitor/vectorscope or other video measurement set that has a line select feature. Line select, as the name implies, lets you look at a single line of video, as opposed to the typical waveform monitor/vectorscope display where all the lines of video are laid on top of each other. VITS measurements are impossible without eliminating the unwanted lines of video from the display.

The necessary tools

As just mentioned, the color signal measurements require specific test signal elements commonly provided by VITS signals. Whether you must insert VITS yourself or use the VITS embedded in the signals you receive, a VITS inserter is involved at some point in the process.

Getting that VITS signal to baseband at the output of the headend imposes the next test equipment requirement. A precision tunable demodulator is the most significant piece of video test gear in a headend. Using anything less to extract the baseband signal for measurement is asking for trouble. Cable demodulators and set-top converters add considerable distortion to the video signal and can't provide an accurate representation of your system's performance. The same can be said of trying to use a TV set or converter with a video output jack.

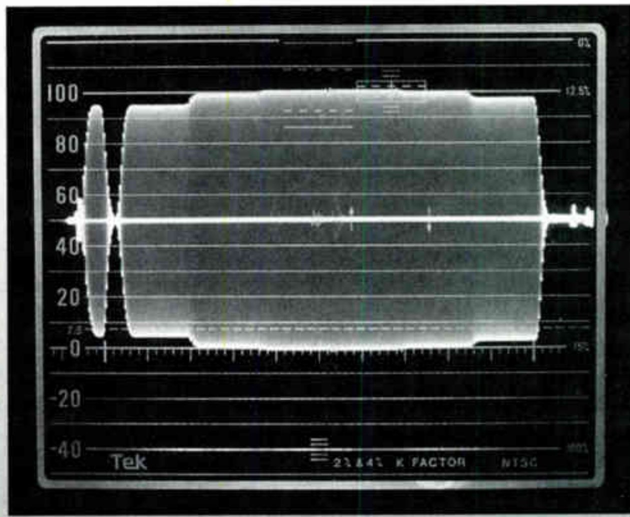
To measure differential gain, differential phase and chrominance-to-luminance delay on the baseband signal, you need either a waveform monitor and vectorscope or a more sophisticated video measurement set. With the waveform monitor you can measure chrominance-to-luminance delay and differential gain, but not differential phase. A vectorscope is required for the differential phase measurement, and it also can measure differential gain, but not chrominance-to-luminance delay. Most test equipment manufacturers offer a combination waveform monitor/vectorscope in a single, portable package. If you own neither a waveform monitor nor a vectorscope, you'll find the combination units an economical and highly portable alternative to the individual instruments. Either way, you'll need both the waveform monitor and vectorscope functions to make the measurements.

The only way around buying a waveform monitor or vectorscope singly or in combination is to use a more sophisticated video measurement set. The advantage of a video measurement set is automation. Create a simple function (a type of macro), push a button and control the entire test setup from the video measurement set, which can be remotely controlled by a personal computer for added convenience. Automatic, accurate report-generation of all the color signal measurements on the necessary channels (or all your channels) can be done by technicians of any skill level.

Calibration

Since the FCC requires that the last date of calibration for all test equipment used in the proof-of-performance testing be included in your reports, it's essential to send your equipment in regularly for calibration. In addition, you should become familiar with the internal calibration signals and controls your test equipment might have to keep it running at its best between trips to the service center.

Figure 2



This modulated staircase signal exhibits a 10 percent differential gain error.

Equipment connections

The equipment connection for these tests is simple. At the output of the headend combiner, feed the wideband signal through a directional coupler to the precision tunable demodulator. The output of the demodulator is fed to the measurement equipment. If you use a separate waveform monitor and vectorscope, loop the baseband signal through the first piece of gear to the second. Regardless of what equipment you use, always make sure the signal is terminated into 75 Ω. Most video measurement equipment requires that an external 75 Ω termination be connected to one side of the video loop-through input. With this setup, you can easily tune in and measure any channel on your system.

Chrominance-to-luminance delay

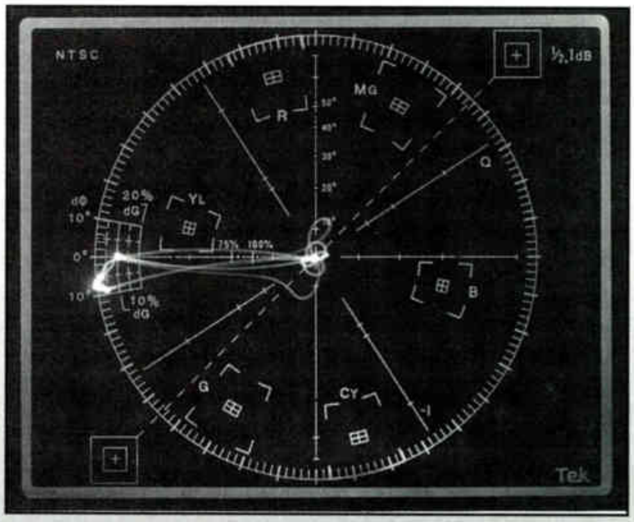
Chrominance-to-luminance (C/Y, sometimes also called C/L) delay error is present when a system delays or advances chrominance with respect to luminance. Smearing or bleeding on the edges of colored objects in a picture are common symptoms. This error causes a sinusoidal distortion to the normally flat baseline of the 12.5T modulated pulse. Figure 1 (page 34) shows a 12.5T mod pulse with approximately 250 nanoseconds of C/Y delay. If a chrominance-to-luminance gain error is present in addition to the delay, the sinusoidal distortion of the pulse's baseline will not be symmetric.

Pure C/Y delay is fairly easy to measure. Use the waveform monitor's variable gain and vertical position controls to set the pulse's baseline on the 0 IRE graticule line, and adjust its amplitude to 100 IRE. Then measure the peak-to-peak amplitude of the sinusoidal distortion. With this vertical gain factor, every 10 IRE of peak-to-peak distortion represents approximately 100 ns of delay. If the first peak of the sinusoidal distortion is positive, chrominance is delayed. Delayed chrominance is reported as a positive number, and advanced chrominance is reported as a negative.

To make the measurement with more resolution, select the X5 vertical gain mode. Remember that the pulse amplitude must first be set to 100 IRE when the waveform monitor's gain is set to 1 volt full scale. Then, in the X5 mode, every 10 IRE of peak-to-peak distortion represents approximately 20 ns of delay. If your waveform monitor is so equipped, measurement cursors yield more accurate results than measurements made straight off a graticule.

Again, asymmetry of the sinusoidal baseline is an indicator of simultaneous C/Y delay and gain errors. When both are present, you need a special nomograph to determine the amount of delay.

Figure 3



This vectorscope display shows simultaneous differential gain and differential phase errors of 10 percent and 9°, respectively.

Differential gain

Differential gain is present if varying the luminance level of a chrominance signal causes the gain of the chrominance signal to change. On a picture monitor, you might notice differential gain on a red object that is partially sunlit and partially shaded. This error might cause the sunlit part of the red object to appear somewhat pinkish when compared to the part in the shade. On the modulated staircase signal, the chrominance packets on each of the five luminance steps of the staircase are nominally 20 IRE peak-to-peak. The amplitude of the packets will not be uniform if a differential gain error exists.

To view differential gain, select the chroma filter on the waveform monitor. This removes the luminance portion of the signal. (Figure 2 on page 35 shows a modulated staircase with the chroma filter on.) Adjust the waveform monitor's variable gain control such that the largest packet is 100 IRE. Measure, in percent, differential gain as the difference in amplitude between the largest and smallest packet. The signal in Figure 2 has a 10 percent differential gain error.

Differential phase

A differential phase error changes the phase of the chrominance signal as the brightness (luminance level) of the chrominance signal changes. This distortion might occur, for example, on a red object that is partly in bright daylight and partly in the shade. Differential phase might cause the red in the sunlit area to shift toward a more purple tone.

Again, the modulated staircase signal is used for this test. Many vectorscopes provide graticule markings for direct measurement of differential gain and phase. While you can make both measurements at once with these graticule markings, the vectorscope doesn't provide as much resolution as the waveform monitor for differential gain measurements.

Measuring differential phase on a vectorscope is easy. Since vectorscopes display phase around the circumference of their graticule, "diff phase" appears as a circumferential spreading of the dots that represent the chrominance packets of the staircase signal. Use the vectorscope's variable gain control to set the tip of the vector on the outer graticule ring. Then use the phase control as necessary to measure the differential gain. Figure 3 shows simultaneous differential gain and differential phase errors of 10 percent and 9°, respectively.

Conclusion

Once some of the issues relating to the color signal measurements are clarified, the process for making them should be easy for anyone. In the meantime, just arm yourself with this information and some appropriate test gear, and you'll be ready to take on another group of the FCC-required measurements. **CT**

Interdiction realities

(Continued from page 19)

able control system. The billing system handles the transactions to the interdiction addressable control system in the same way as the home terminal transactions have been handled for close to a decade. Given addressable control of any drop, services to non-subscribers become a billing control issue. A non-subscriber account must be qualified for credit, retained in the billing data base and billable upon a purchase of selected services. The interdiction port must be tied to the house account permanently. Tracking multiple homes from one interdiction unit must be possible. To date, several of the major billing vendors have realized and have developed a billing system with the flexibility to handle interdiction. (For more on this, see "Interdiction and the subscriber management system" on page 25.)

• *Distribution design.* Unlike addressable home terminals, interdiction is incorporated in the new-build or rebuild phase of the distribution system. (See "Designing with interdiction" on page 20.) Interdiction is designed into the feeder system much as a passive tap. The interdiction unit has a tap loss figure based upon a plug-in directional coupler. In addition, an equalizer is used in each interdiction unit to uptilt the drop spectrum. Commercial design companies have succeeded in developing the needed design programs for interdiction and have achieved high accuracy in the design process. Interdiction has internal automatic gain control (AGC) for maintaining the proper relationship between the CATV spectrum and the jamming carriers. Maintaining the relationship means the interdiction unit has a fixed drop output level at 15 dBmV at 450 MHz with a 5 dB uptilt. Long drop cables or multiple outlet homes have traditionally gotten a higher tap output level commonly referred to as a "hot drop." However, with cumulative leakage index (CLI) requirements, many cable systems are opting for in-home amplifiers when levels fall below specification.

The design process predicts system levels at each location, but the prediction is conservative and based upon all worst-case cable, passive and active losses. Traditionally, this has the effect of requiring the installation crews to measure and balance the amplifier equipment rather than using the predicted values. Interdiction requires balancing similar to amplifiers. The installer uses a signal level meter to select a directional coupler and equalizer for setting the interdiction unit at proper levels. The installation process takes the same time as a passive tap. Balancing the interdiction unit takes typically 10 to 15 minutes per unit. After balancing, each drop is uniform in its level and tilt. Unlike amplifiers, interdiction balancing is not a continuing process. The latitude provided by the internal AGC and the jamming system allow ±4.5 dB changes in the feeder levels without the jamming security being compromised.

The realities

The realities created in an interdiction environment are tied to the fact that it takes a whole-house approach to cable service. The drop becomes a service conduit to the home rather than providing services to an individual TV set. The drop becomes an extension of the feeder plant from which the service level of any connected subscriber or non-subscriber is controlled remotely.

• *Reducing truck rolls.* The main reality is in the area of truck roll reduction. Interdiction's addressable control of service level and remote disconnect/reconnect capability have combined to reduce the service technician's time used for installs, disconnects and drop maintenance. Truck rolls don't disappear, but do reduce in number and shift toward preventive maintenance and proactive correction of problems before they become visible to subscribers. The reduction has the effect of decreased overall maintenance costs. Preventive maintenance can increase the reliability of the cable system and improve subscriber satisfaction. Subscriber satisfaction also has increased due to the instant install capability. With interdiction and a drop cable in place, a customer then can be turned on immediately without the typical lead time and home visit requirements.

"Interdiction is one of the most reliable, secure, subscriber-friendly, future-ready alternatives for conditional access of cable TV services."

• *Undefeated security.* Security is one of the main considerations in a conditional access system. Interdiction places a jamming carrier within the video passband of a channel to obliterate the video and produce an audio buzz byproduct. Once jamming is placed in the channel, the channel is permanently secured, short of bypassing the interdiction device all together. Traditional theft occurs from illegal connection to the tap and illegal scrambling decoders. An interdiction port in disconnect status produces no RF and therefore provides no mode for theft. No device has been found for defeating the interdiction security. In fact, interdiction can render useless all unauthorized descrambling. Also, interdiction does not require a home terminal, so the potential for terminal theft is drastically reduced. In fact, the operators using interdiction maintain that theft rates are almost zero. This pales in comparison to conventional systems, which average 10 to 15 percent theft-of-service. Interdiction removes the conditional access from the home environment and virtually eliminates signal theft.

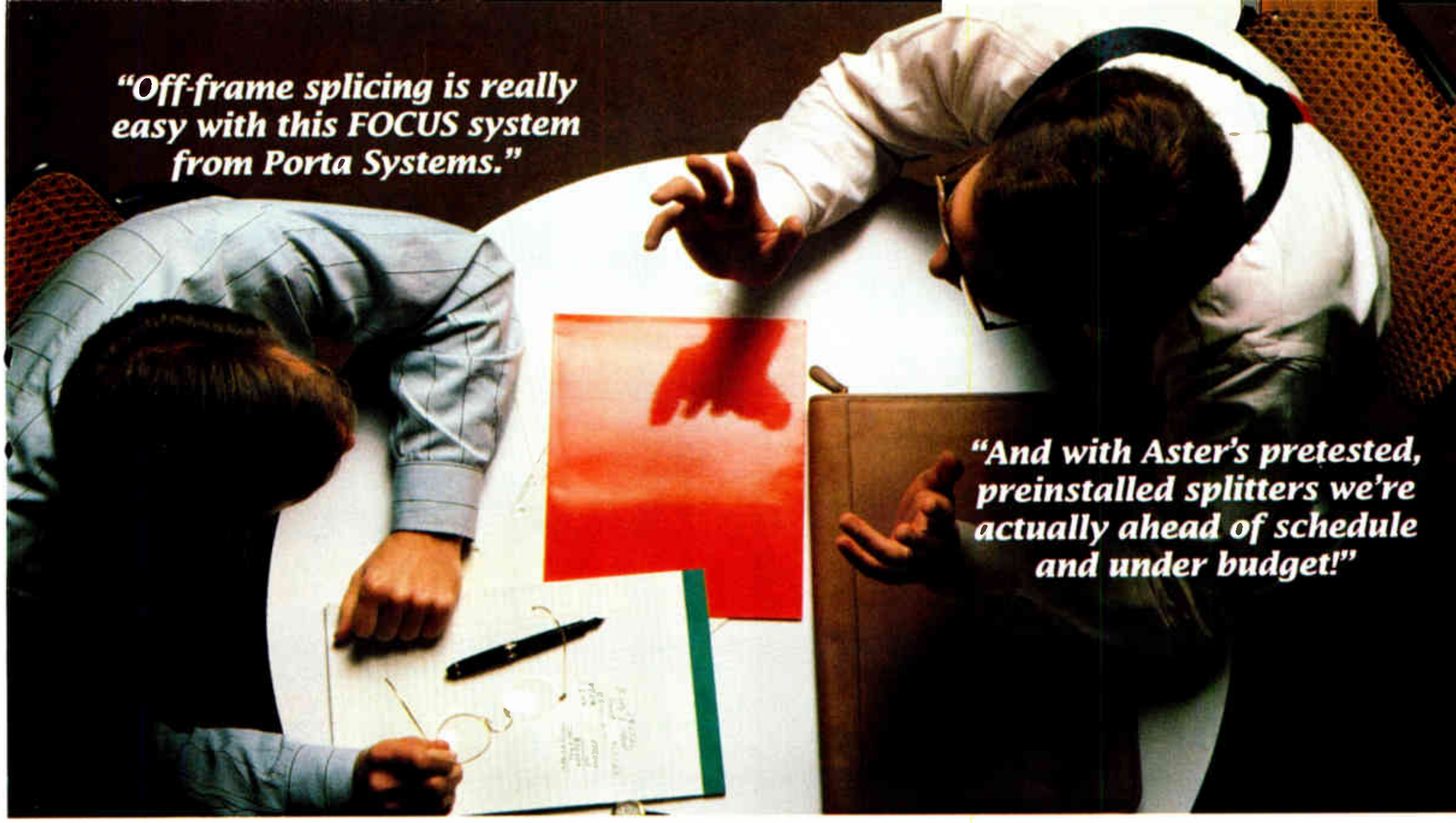
- *Serving all TV sets in the home.* Interdiction has increased basic subscriber satisfaction because every cable-compatible TV set or VCR in the house gets the same service level. Most operators believe that additional outlet revenue would go to zero under this scenario. Quite surprisingly, additional outlets have gone up approximately 15 percent and older TV sets of the non-cable-ready variety are being added with the need for basic converters and remotes at about a 10 percent rate. Interdiction raises pay subscriber satisfaction by not scrambling the pay channel video. The pay subscriber gets the best video picture available without any scrambling-related artifacts. Statistics from studies show pay penetration remained flat in interdiction systems compared with declines in the control and set-top terminal areas. Surveys have shown that subscriber satisfaction has increased due directly to interdiction.

- *Added revenues.* Additional incremental revenue possibilities exist. The interdiction product is addressable and is compatible with conventional phone-in PPV even for non-subscribers. Interdiction's capabilities, remote control of channel authorizations and disconnect/reconnect, allows unbundling of the cable services and NVOD. Partial tier or cable-by-the-day services can be provided. Some ideas for service are still experimental, but the trend says that if the subscriber finds the value and convenience, then it will be seen and a revenue lift will be realized.

- *Pocket deployment.* Pocket deployment is a term used to describe the placement of interdiction in a relatively small area of consumers that typically are of high density, high churn and/or high theft areas as shown in Figure 2 (page 19). Interdiction has been installed in hospital, hotel, recreational, seasonal and other normally high churn areas. Interdiction fits especially well into the hospital environment because the addressable control electronics do not have to reside in the hospital room where they are subject to OSHA regulations and special UL requirements. (See "Interdiction in a hospital environment" on page 22.) Interdiction also is well-suited to satisfy seasonal or occasional subscribers with a minimum of recurring expense and manpower.

Summary

Interdiction is one of the most reliable, secure, subscriber-friendly, future-ready alternatives for conditional access of cable TV services. The initial challenges faced by interdiction have been overcome. The interdiction product complements the capabilities of digitally compressed video and is a viable conditional access device for the foreseeable future. More cable operators are utilizing interdiction because it adds value to cable service, increases subscriber satisfaction, significantly reduces theft, and reduces the operating costs and lost revenues of the cable system. **CT**



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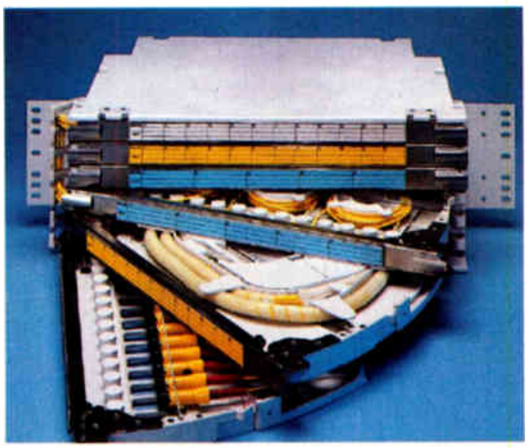

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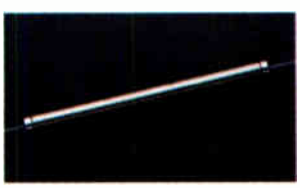

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Reader Service Number 30

Designing with interdiction

(Continued from page 20)

ly contains a 21 dB directional coupler feeding a 4-way splitter. Total combined coupler and splitter losses equal the ordered value. We're accustomed to considering the unit in total tap value and ignoring internal components, since we can't configure them anyway.

In contrast, the interdiction device is often used in the 4-port unit configuration (single-port and 8-port available depending on manufacturer used), without specific value. You then purchase a plug-in directional coupler and equalizer for the device that when installed gives the unit an overall value — as in a multitap. When designing with interdiction, the optimal design calculation process is to choose actual DC and equalizer values. However, it can be done using "equivalent tap values" — which represent the overall value of an interdiction tap with each available DC value. Table 2 illustrates an equivalent interdiction tap chart, DC values and representative equivalent tap values for each case. A design program can be loaded with these equivalent values and designed in that fashion. The problem with that approach is that you'll have to order your equalizers and couplers using some sort of projected distribution of use, rather than from a specific bill of materials (BOM) developed during the design process.

As can be seen by scanning Table 2, the units do not have unity gain from coupler leg output to tap port, with roughly 5 to 7 dB of extra loss incurred. More efficient designs can be realized with unity gain in this portion of the leg, and at least one manufacturer offers additional gain in this portion of the circuitry (which helps to realize improved design efficiencies).

2) *Tap port efficiency and long drops*. Tap port efficiency sounds rather obscure, but in fact represents an ever present but often ignored subject. The phrase has been coined to describe a phenomena that has been with us because multitaps came into use, but has not caused any serious concern until now. Tap port efficiency describes the following effect: Nor-

Table 2: Tap equivalency chart

Coupler value	Tap equivalent	Maximum (through) insertion loss			
		50 MHz	330 MHz	450 MHz	550 MHz
0.0	7.0		Terminating values		
1.0	8.0				
2.0	9.0				
3.0	9.5				
4.0	11.5	3.4	3.6	3.7	3.8
5.0	12.5	3.4	3.6	3.7	3.8
6.0	14.0	2.0	2.1	2.2	2.3
7.5	14.5	2.0	2.1	2.2	2.3
9.0	16.0	1.3	1.6	1.8	2.0
10.5	17.0	1.3	1.6	1.8	2.0
12.0	19.0	0.6	0.8	1.0	1.2
13.5	20.0	0.6	0.8	1.0	1.2
15.0	20.5	0.6	0.8	1.0	1.2
16.5	22.0	0.5	0.6	0.8	0.9
18.0	23.5	0.5	0.6	0.8	0.9
19.5	24.0	0.5	0.6	0.8	0.9
21.0	26.0	0.5	0.6	0.8	0.9
22.5	27.0	0.5	0.6	0.8	0.9
24.0	28.5	0.5	0.6	0.8	0.9
25.5	30.0	0.5	0.6	0.8	0.9
27.0	32.0	0.5	0.6	0.8	0.9
28.5	33.0	0.5	0.6	0.8	0.9
30.0	34.0	0.5	0.6	0.8	0.9
31.5	35.0	0.5	0.6	0.8	0.9

"It is important to note at the onset that the interdiction tap or device is active in nature, as opposed to the passive multitap we are so familiar with and typically employ in current designs."

mal multitap design involves placing 2-, 4- and 8-way taps close to homes to be fed. Close would typically be defined as acceptable drop lengths to any home and normally fed with RG-59 cable. (There has been an industry movement toward RG-6 of late as we design higher bandwidth systems. RG-6 brings lower loss at higher frequencies plus greater physical strength.) In designing, we often place a 2-way tap where only one potential home is to be fed, a 4-way tap where only two or three homes are to be fed, and an 8-way where perhaps only five or six homes are located. "Potential" here references homes passed, and regrettably not all homes passed become or remain active subscribers.

Both of these effects combine to form the following situation: Even if all homes passed were subscribers, all tap ports would not be used — some would still be vacant. Further, because basic penetration remains less than 100 percent, this effect is compounded. In typical designs I've examined, the tap port efficiency or usage rate can range from a low of 50-60 percent to a high of 80-90 percent. This problem is somewhat further compounded with current interdiction choices: one manufacturer offers 4- and 8-port only; another offers single- and 4-port.

With passive multitap design, which involves average costs of perhaps $15 to $20 per multitap including connectors, this low usage rate causes only a slight system cost escalation. With interdiction design, where the housing and motherboard alone may cost well over $100 (without subscriber modules), this creates a potentially serious cost escalation for the plant design, and new points of concern for the designer. Current methods to minimize this problem are few. Strategic placement of 4-port units is crucial, *especially in underground design*. Where the designer may feel free in multitap design to place a pedestal with multitap every two homes on lot lines, the cost of the 4-port interdiction motherboard and housing makes this practice prohibitive. Every effort should be made to place 4-port units where they can serve three or four homes passed. Strategic use of slightly longer drops using RG-6/RG-11 rather than RG-59 also can help to optimize tap placement. In a comparative pricing analysis conducted, keeping all other variables constant, this tap efficiency problem has been seen to increase overall system equipment costs by as much as 5 percent, as compared to a system that could achieve total tap port usage (the effect of port non-use due to basic penetration rates was not included in this analysis).

3) *Interdiction tap distortion considerations*. When calculating and estimating system performance with interdiction, calculations are done in the normal fashion, but include the interdiction tap as the last device before the subscriber's equipment. Because the interdiction electronics are in the subscriber loop section only, a cascade of one

Table 3: Sample system distortion results

Equipment type	Parameter	Out of last amp	With interdiction	With converter
Push-pull line equipment	C/N	51.5	49.3	49.7
	CTB	-54.1	-49.5	-53.2
	X-MOD	-54.7	-50.9	-54.0
	DSO	-63.5	-57.8	-61.3
Feedfwd + parallel hybrid equipment	C/N	45.0	44.4	44.6
	CTB	-59.0	-51.9	-57.1
	X-MOD	-58.9	-53.4	-57.5
	DSO	-67.1	-58.8	-63.5

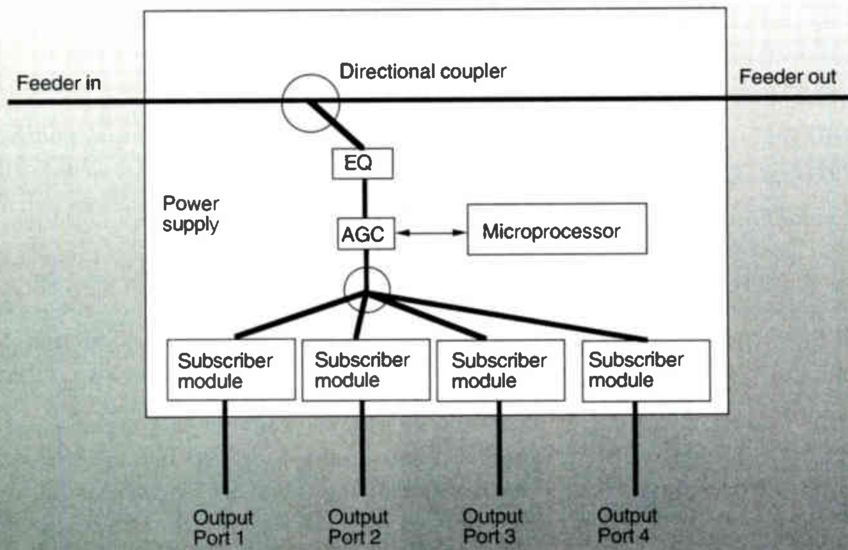
interdiction unit is all that any given customer sees. The situation is quite analogous to converters, which enter into the overall distortion process — but only a single unit per subscriber cascade is seen. Noise and distortion parameters also are quite similar to converters, which the industry has found manageable to date. Operating levels for the interdiction unit vs. converter are not the same, and some variance is therefore found when combining system distortions. Table 3 illustrates some sample system distortion results, with and without the interdiction device employed in the system. The final column in this table illustrates analysis with a typical baseband converter.

The first series of calculations uses standard push-pull equipment with a cascade of eight trunks, plus bridger and two line extenders, and a single interdiction tap or RF converter. Sixty-two channel loading was utilized, and feeder power levels had to be reduced in this push-pull example to maintain acceptable distortion levels in the design. Design efficiency and overall range of design would therefore be diminished. The second example uses feedforward trunk and bridgers, plus parallel hybrid line extenders with a cascade of 8 + 1 + 2. Seventy-eight channel loading was used in this run, and feeder levels were run 1 dB higher than the push-pull example.

While comparable in noise addition, degradation in distortions is noticeably worse with the interdiction device as compared to the converter. The interdiction unit certainly contributes a measurable amount of distortion to the signal delivered to the home, and when calculating overall system performance one must carefully include this in the analysis. Further, because current interdiction units employ push-pull technology, their use in a system contributes a higher than normal percentage as compared to normal experience. It should be fairly noted that because the interdiction device only "jams" or interferes with the channels that the customer is not to receive, some immeasurable but perceptible advantage is gained in the jamming approach as compared to scrambling. In other words, because scrambling techniques require picture reconstruction and the jamming approach does not, some increased distortion addition is likely tolerable and comparisons between the two must be made carefully. Given all of that, however, the preceding exercise points to the fact that the designer must carefully consider the interdiction unit, especially when system operational levels are chosen. During my calculations, I found that it was necessary (at least in the push-pull example) to lower operational levels by 1 dB to maintain adequate tolerances when using interdiction. **CT**

Part 2 will of this article will cover RF design considerations and AC powering for interdiction.

Figure 2: Output to drop port



Hospitals

(Continued from page 22)

fusing element to the room. Also, many patient rooms are semiprivate with more than one bed (and TV set) per room. Imagine the chaos of dueling remote controls in such a room! In some situations, there are small 9-inch TV sets attached to extensible arms by the beds. Placement and use of converters and remotes would be very difficult here.

Third, maintenance is much less intrusive. Hospitals are extremely protective of their patients and discourage unnecessary visits to patient rooms. With off-premises technology, taps may be maintained without entering the room at all. Maintaining and replacing converters and remote controls (including their batteries) is not an issue. Further, TV sets may be swapped out simply by replacing the set and reconnecting the F-fitting.

As John Keith, director of information systems at Baptist Hospital points out, "We were insistent that, whatever system was installed, it minimize patient disruption, conform to all hospital electrical codes and be compatible with existing hospital equipment. We also wanted to make sure that support was available directly from a reputable manufacturer."

Additional benefits of the interdiction system are security and bandwidth. Since there are no converters and remote controls in the patient room, there is no temptation for theft-of-service or equipment theft. Also, since the system is not constrained in 6 MHz sections, higher bandwidth signals can be transmitted through the system. Hospitals are looking at transmitting all types of images through these systems (e.g., ultrasound, X-ray, MRI, HDTV, etc.). →

Finally, during any given month virtually all beds (which can be thought of as homes passed) will order cable service several times as patients change, so the economics of interdiction are attractive. In essence, the capital costs of installing a tap at every "home" is mitigated by the fact that every "home" will have at least one (and probably several) subscribers during the course of the month.

"During any given month virtually all beds ... will order cable service several times as patients change, so the economics of interdiction are attractive."

Baptist Hospital experience

Once all of the technical issues are resolved, installation in a hospital remains a challenging proposition. COM1 entered into a relationship with Cox Cable of Pensacola to install and maintain the system, as well as to provide a comprehensive package of cable TV programming. Despite the fact that this was both COM1's and Cox's first experience with interdiction technology, the actual construction of the system went smoothly.

The only particularly complicated process was the balancing of the system. As mentioned previously, while good design can get you close to the needed directional coupler and equalizer values needed at each housing, it became obvious that actual measurement of the input signal at each housing was needed to correctly select these values. Troubleshooting during and after installation proved simple due to the fact that almost all problems could quickly be narrowed down to either a housing- or module-related problem.

Headend design was based on several considerations. First of all, the interdiction system (in the 330 MHz system used at Baptist Hospital) cannot interdict Chs. 2-6. (This is different from the 450 MHz system.) Since Cox Cable was providing its normal channel lineup, some channel swapping was required. This was accomplished through the use of S-A processors and modulators, and channel deletion filters supplied by Microwave Filter Co. Several local origination channels also were provided for staff and patient education purposes. Nexus Display supplied the video equipment and character generators used here.

The operation of the system is extremely flexible. The ATX, which controls the subscriber modules, is connected to a billing system computer, which in turn is connected to the ARU. The ARU allows a patient, nurse or doctor to call the system and order cable TV or educational services using a simple voice menu and a Touch Tone phone. In addition, the on-site CSR can enter changes in services directly from the billing system computer. Since patients are admitted and discharged frequently and move from room to room, it is important to be in close contact with the patient tracking system used in the hospital.

Conclusion

Hospitals are a unique operating environment and require unique solutions. Interdiction technology seems to provide the best single solution to the challenges of serving hospitals. **CT**

The future of addressability

(Continued from page 26)

and disadvantages of each device.

As Table 1 shows, the TV set's unique advantage lies in its display capability. TV sets process video at RGB as opposed to VCRs and converters, which must utilize composite video and therefore lose some color intensity and character definition in processing. VCRs rate relatively high in user utility when one considers the mechanics of time-shift recording. Today, a subscriber must face the daunting task of setting the VCR clock correctly and properly entering information in the VCR set-up sequence. In the very near future, a subscriber will simply highlight the proper cell in an interactive program guide. TV sets and cable converters will have similar utility, but will require some kind of interface to the other devices in the consumer electronics chain. (See the accompanying figure on page 26.)

Although cable converters require an interface to a VCR for IPG-automated recording, other "linked" services, such as setting the converter's timer or buying PPV from the program grid, can only be accomplished through the converter.

Converters have a natural advantage for data acquisition for two reasons — data access and data speed. It is easy to understand why converters have better access to data if the typical subscriber hook-up configuration is considered. As in the figure, the decoder is generally the first device in the home electronics chain in any scrambling-based system. If a subscriber wishes to tape an encoded channel, the VCR must be placed beyond the decoder unless a special hook-up arrangement is made. TV sets and VCRs run the risk of having their access to data blocked by the preceding devices. This access problem can be particularly debilitating for supporting services that require continual updating, such as sports scores and stock quotes.

Table 1: Comparison of in-home devices

	Display capability	Subscriber utility	Data acquisition
TV set	Excellent	Good	Fair
VCR	Good	Very good	Good
Converter	Good	Very good	Excellent

In-band vs. out-of-band

The speed at which data is sent to a decoder is interwoven with the consideration of whether the data is transmitted in-band or out-of-band. In-band data generally means inserting data in the vertical blanking interval. As part of the 1990 Television Decoder Circuitry Act, broadcast standards already have been developed for sending data via the VBI and manufacturers have long used it for controlling addressable decoders. However, as larger amounts of data are sent to decoders, the use of in-band data could prove ineffective. Table 2 compares the hypothetical loading times for in- and out-of-band data transmission scenarios.

Table 2: Loading times for data transmission scenarios

Transmission method	Estimated throughput	Effective data rate	128 kbyte download
VBI data[1]	60%[2]	640 bits/s	27.3 minutes
Out-of-band 9,600 baud data	80%[3]	7,680 bits/s	2.3 minutes

[1]Assumes closed-captioning data rate.
[2]Assumes 40 percent overhead for error correction and other considerations.
[3]Out-of-band FSK data less susceptible to impulse noise than amplitude-modulated VBI data.

In this scenario, out-of-band data is roughly 12 times faster than in-band data. It also is important to note that the data rates are calculated as if no other kinds of data are interwoven with the information data, and none of the data is sent repetitively — two fairly unreasonable assumptions. Whether an operator is sending informational data to a converter, a VCR or a TV set, it is quite likely that conditional access data will be multiplexed with the informational data, thus slowing the effective data rate of the information data. And, in the case of in-band data, it is virtually a necessity that all data be sent repetitively, since the receiver for any in-band receiving device only sees data when tuned to data-encoded channels.

Real-time interactive systems will play an increasingly important role in the future of addressability. Certain sporadically accessed, data-intensive services such as itemized customer bills or financial reports will be served most efficiently by real-time two-way systems. Channel monitoring, where an operator can poll boxes and obtain an instantaneous "snapshot" reflection of viewership, will deliver information that is not only valuable for internal use, but will be saleable to outside sources as well. Real-time two-way interactions with subscribers provide many creative opportunities. Witness KBLCOM's recently announced "Star Response" system where, in one application, a two-way command initiated through the remote provides next-day, consumer-specific advertising information about products and services.

The future starts today

As the cable industry progresses, the opportunities presented by a more digitized world are both startling and subtle. Obviously, digital signals will make a place for both NTSC compression and high definition TV (HDTV) — two powerful, industry-changing developments. The coordination of these two potentially related technologies may allow the industry to make a clean break from the electronic redundancy with which subscribers have long suffered. If we can standardize with, at a minimum, a common modulation technique between NTSC compression and HDTV we can much more easily tap into the processing capability of HDTV — leaving only a conditional access device for cable operators to provide and, most importantly, to finance. Now is the time to address this problem.

Regardless of how the worlds of NTSC compression and HDTV develop, the opportunity to begin to generate revenues from data services is upon us. Addressable technology will continue to flourish with the advent of digital technology but, if you believe in the potential of data services on cable, the future starts today. **CT**

System engineering managers

(Continued from page 31)

ments at an incremental cost of 7 percent. The resultant savings to the future full deployment of the competitive access ring could be on the order of 30 percent. The point is to begin thinking in competitive, strategic terms.

The challenge of external focusing

Traditionally, the system engineering manager's focus tends to be within franchise boundaries; plant is designed and built accordingly. Operations tend to center within these islands of isolated networks. As a consequence, technical standards are minimized and there exist no real requirements for interoperability. However, the development of personal communications services (PCSs), competitive access networks and deployment of the broadband ISDN will dictate the adoption of standards and connectivity with the outside world. To take advantage of these rising business opportunities, system engineers will need to pay close attention to activities in areas beyond their franchise boundaries.

As an example, consider a situation wherein a fiber project is being planned. Should consideration be given to modified routing and adding excess fibers and additional splice points for future connectivity to adjacent cable operators' or competitive access providers' fiber plants? External focusing also alludes to viewing opportunities beyond traditional business boundaries. For example, during a rebuild project where fiber-optic technology is being employed, the traditional approach might be to remove the old coaxial plant as the rebuild is completed. But suppose the old plant remained in place. Could it be used for some non-cable applications in the future where high-speed data was not a concern? Could it be the highway for connecting city government facilities, or schools, or power utility substations, or vehicular traffic control signaling devices?

The challenge of external focusing is to view the world globally. Understand the forces that will drive future decisions and create new opportunities. The forces that will influence decisions in the coming century (less than eight years away) will include energy conservation, environmental protection concerns, education and personal security. The challenge for the system engineering manager is to translate these external issues into future opportunities by integrating future requirements estimates into current and near-term projects.

The challenge of inclusion

While systems' general managers, marketing managers and business managers typically have managerial experience outside the CATV industry, system engineering managers remain a product of the industry. With the very rare exception, they have worked their way through the technical ranks and have gained their managerial skills and experience through the rigors of on-the-job training. The positive aspect is system engineers thoroughly understand cable TV, but, the drawback is a general lack of the global perspective. To successfully compete in non-traditional service areas, the system engineering manager will need to be on par with non-cable engineers. As the future unfolds and cable operators transition toward transport provisioning, engineering professional from outside the industry will be called upon to provide expertise not currently contained within operators' general corps of managing engineers.

The challenge for the industry will be to develop a method for attracting these degreed engineers. The challenges for the system engineering managers are twofold. First, system engineers must attract newly graduated degreed engineers into their operating systems and secondly develop an acceptance rather than a fear of including outside engineering professionals in our technical management positions. We should embrace these "outsiders" as a source for stimulating new thinking and vision while developing a companion strategy for improving our own professional credentials recognized beyond the bounds of CATV.

Summary

The cable industry is in the midst of change. The forces driving our future direction are global and long-term in nature. They will require a strategic viewpoint, competitive thinking, external focusing and inclusion of "outside" professionals. While managers will unanimously agree that the most difficult challenges they face are responding to and resolving personnel issues, the toughest challenges faced are in fact those of change. Whether the system engineering manager chooses to embrace, resist or ignore the coming change, one thing is certain — change is inevitable. **CT**

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System technical management

(Continued from page 32)

chanical or electronic equipment used in the cable plant and business office. In addition, the bench repair technician(s) must keep full documentation (including history) on all equipment that is repaired. The technical manager must set up policies and procedures in the bench repair area to ensure the most efficient operation.

Stocking

Warehousing and purchasing requires ongoing attention from the technical manager. The system must have the required equipment in stock when it is needed. However, stocking excess inventory far in advance ties up the financial resources of the company and requires additional floor space and inventory management time. Obviously, the best solution is to have equipment delivered the day it is needed. This is impractical, if not impossible, to achieve in reality. Therefore, the best coordination approaching the ideal solution will have to be accepted. Additionally, accounting policies require the technical manager's approval of all technical purchases. This alone often requires the review and signing of many purchase orders, receiving memos and invoice approvals on a daily basis.

Additional construction

Expansion of the cable plant or new-build requires a large amount of the technical manager's time during the planning process. Discussions and agreements with civil engineering firms and developers are ongoing processes in high-growth states. If new-build is neglected, the franchise territory will be put in jeopardy by competitors and franchiser animosity will result. The technical manager must stay attuned to all details in the construction department.

Rebuild is similar to new-build. With the advent of fiber-optic cable, the rebuild/upgrade activity has greatly increased. However, even with increased fiber activity, the need for coaxial cable new-build still exists and cannot be ignored. The technical manager must be aware of all construction needs and use his most persuasive skills during the budgeting process.

Educating technical staff

Training of the technical staff is a very important activity. Technology is changing so rapidly in the cable industry that it is very hard to stay abreast of all new technology and techniques. A dedicated program of correspondence courses, Society of Cable Television Engineers seminar attendance and in-house training often achieves satisfactory technical growth within the staff. Broadband Communications Technician/Engineer (BCT/E) and Installer Certification sponsored by the SCTE often enhances self-esteem and gives self-confidence to technicians and installers. It is well worth the cost to support all such training programs. Management usually supports correspondence and in-house programs. However, it is often difficult to get management financial support for technical seminars for other than supervisors. The technical manager must not only support, but take the lead, in training the technical staff.

Self-improvement and continuing education have very important roles in the life of a technical manager. Continuing education is easier to promote if the technical leader sets an example. With the widespread use of personal computers, computer software skills in spreadsheets, data base programs and word processors are now a necessity for the technical manager. Most technical managers type their own correspondence on word processors and use spreadsheet or data base programs to budget and forecast the requirements of technical operations. Staying current on system design architecture and specifications of fiber systems, both analog and digital, also is necessary.

Selecting and motivating technical personnel will not be discussed in this article. Because of its magnitude, such a topic requires multifaceted discussion and should be the subject of a complete article within itself. Therefore, a future article on this subject is appropriate.

To summarize, the technical manager has a diverse and challenging scope of responsibility. The previously discussed areas of responsibility will differ from system to system, but the challenge in the technical area remains tremendous. Technical management is never boring nor repetitive. There will continue to be opportunities for aggressive, qualified technicians who wish to move into technical management. **CT**

November 1992

BACK TO BASICS

MDU construction

The training and educational supplement to Communications Technology magazine.

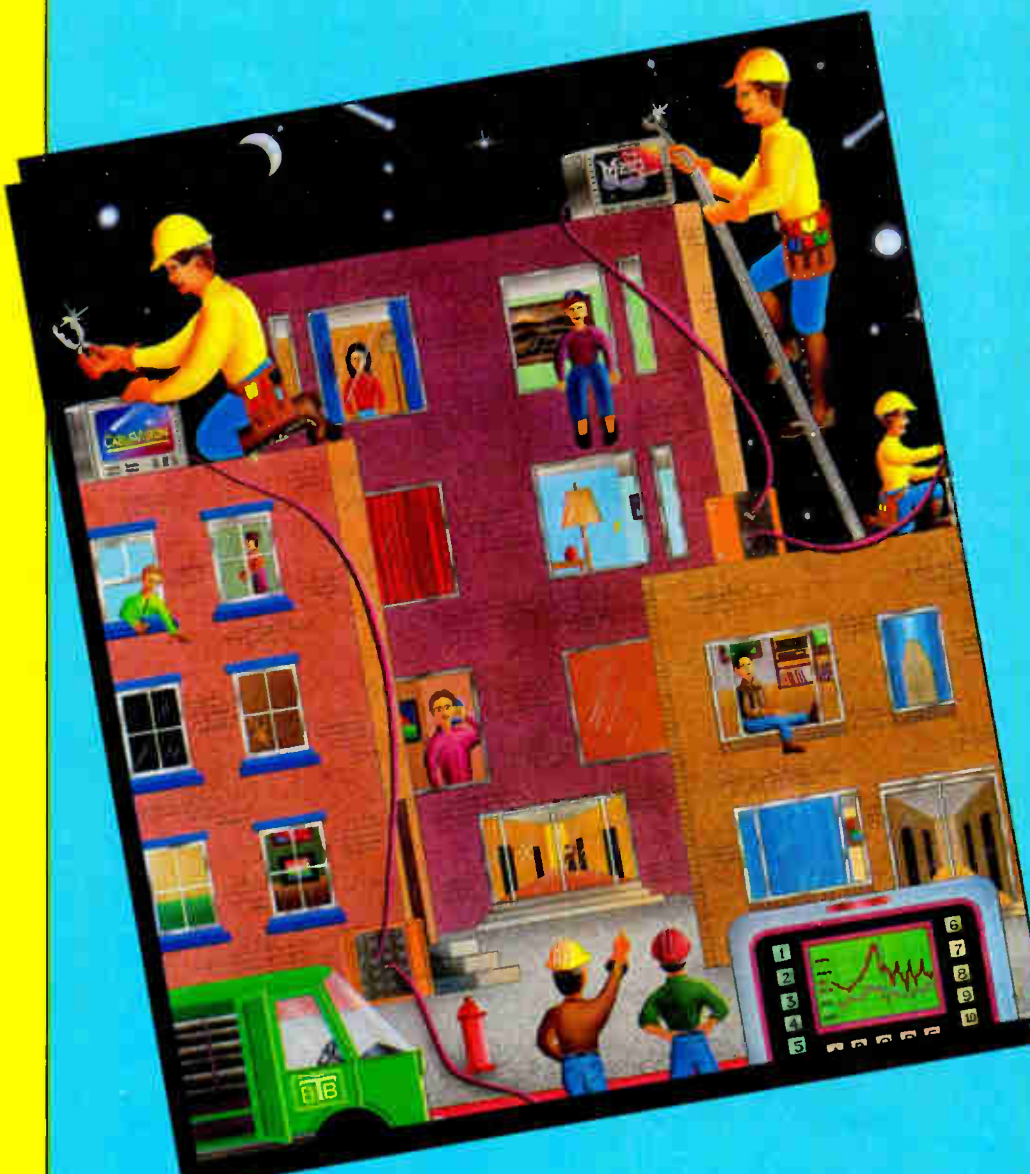

Gen Saye

Table of Contents

Considerations for the MDU install

Our thanks to the Society of Cable Television Engineers for permission to reprint this excerpt from its "Installer Certification Manual." For further information about the Installer Certification Program and the manual, please contact SCTE: 669 Exton Commons, Exton, Pa. 19341; phone, (215) 363-6888.

One of the most difficult and time-consuming tasks you will face as an installer will be the wiring of multiple dwelling units (MDUs), which include apartment buildings, hotels, motels and other buildings where more than one family resides or stays.

Aside from the obvious consideration of more than the normal number of outlets, there are several other factors that must be examined prior to beginning the wiring of an MDU. Although it is not the intent of this article to deal with all of the different situations that could arise, the principles and methods discussed should give you a general knowledge of how to develop a plan for an installation that will best meet your objectives. We will deal with the wiring of buildings that are already constructed and occupied.

General guidelines

The nature of the work you will be performing in wiring MDUs is quite similar to the wiring of an individual residence. However, because of the differences in the scope and size of the projects, some special rules apply:

• Be cautious of where your tools and equipment are at all times. There is typically a much higher traffic level in an MDU, and the careless placement of tools and equipment can create a safety hazard as well as result in loss of valuable equipment.

"Your primary objective in selecting cable routings should be to wire the building with the shortest possible cable runs, while making the system as neat and inconspicuous as possible."

• When working on several units at the same time, try to finish the inside work that would require the tenant's presence as quickly as possible. This will avoid unnecessary waiting.

• Be extremely careful before drilling any holes. It is considerably more difficult in most MDUs to determine the exit point of your drill. There may be wiring and other obstructions in seemingly illogical places.

• Although always important, be especially courteous in your contact with the tenants in MDUs. Remember that a complaint from a single tenant could prompt the owner of the property to deny your company access to the entire building. This can result in the loss of dozens, or even hundreds, of potential subscribers.

• Make certain that all cables are clearly marked as to their destination. A few extra minutes here can save countless hours of sorting and testing cables during future trips to the building.

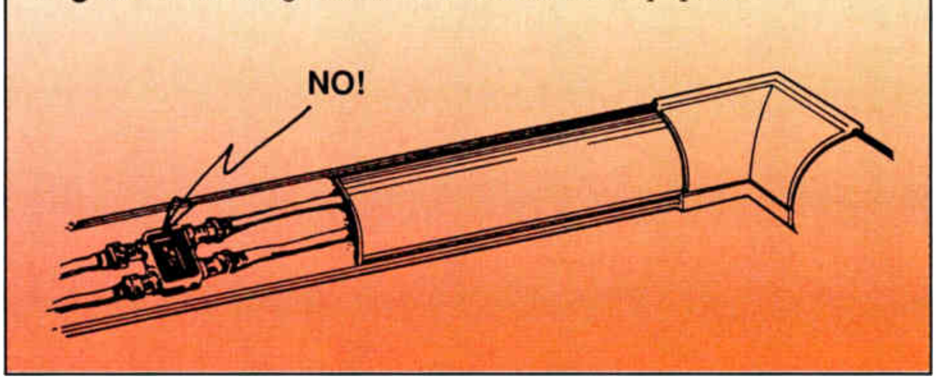


Figure 1: Molding duct with cable and 3-way splitter

• Try to keep wiring as inaccessible as possible throughout the job. "Wiretapping" seems to be a favorite pastime in many MDUs, and many cases of illegal tap-ins can be eliminated by making the task more difficult.

Building access

One of the most important differences between the wiring of residential units and installation of MDUs is the fact that the building is nearly always owned by someone other than the individual who has requested cable service. The building owner may or may not allow the cable company to wire the residences and you must verify that the owner's permission has been obtained prior to beginning the installation.

The document allowing the cable company access to the premises is generally referred to as a "Right of Entry Agreement," and it sets forth the conditions under which we may install and service our equipment on the owner's property. While these agreements may occasionally make your task of installing more difficult because of special conditions and routing requirements, it is important to remember that the owner has/may have (depending on recent legislation) the right to refuse your company access to the premises. Thus, the owner could prevent the connection of potential subscribers. For this reason, it is very important that all of the conditions contained in the "Right of Entry Agreement" be followed to the best of your ability.

If it is necessary to deviate from the agreement in any way, you should advise your superior before proceeding to ensure that the necessary changes are made to the agreement.

Site survey

In order to perform the task of wiring an MDU with a minimal amount of unsightly and/or exposed wiring, carefully examine the building for the best possible cable routing(s). A well-designed installation lessens the chances of illegal connections as well.

Floor plan

The first task in conducting a site survey is to lay out a rough floor plan if one has not been provided for your use. Be as accurate as possible in estimating or measuring footage so that signal levels can be calculated based on the amount of cable feeding into each unit.

Wiring origination points

A location must be selected for an origination point for the wiring to the individual units. The design and wiring tasks are much simplified if the location is close to an equal distance from all units. One important criteria in selecting such a location is that the wiring at the origination point can be made inaccessible to unauthorized individuals yet easily accessible by technicians and installers. If possible, an inside location would be preferable since it affords shielding from weather.

Measuring footage

The distance from the central origination location to each unit should be recorded. It is important that the route the cable will follow is used to measure or estimate footage, and that any obstructions that may force longer cable routes be taken into account. In cases where the distance to each unit is approximately equal the distance to any one of the units, the longest footage should be used for calculation.

Amplifiers

In the case of larger buildings (usually 10 units or more), it may be necessary to design an amplifier into the system.

The use of amplifiers in an MDU can take many forms, ranging from small 10 dB amplifiers that operate on house current, to the use of trunk and bridger amplifiers, line extenders and other items normally associated with an outside plant. In these instances, the routing and footage information should be gathered and forwarded to the system designer.

High-rise buildings

In particularly large buildings with many floors, it may be necessary to select an origination point on each floor or every other floor. Feeder lines will be designed to feed from these points. If more than one origination point is necessary, the distance between the origination points also must be recorded.

Wiring methods and cable routing

In order to accurately determine the footage of cable that will be necessary for each unit, you must first select a routing for each cable. Your primary objective in selecting cable routings should be to wire the building with the shortest possible cable runs, while making the system as neat and inconspicuous as possible.

Keep in mind that a substandard wiring job by other parties (such as phone or antenna contractors) is not a justification for your work to be substandard. Design and wire each unit and building as if you owned it and take pride in a professional installation.

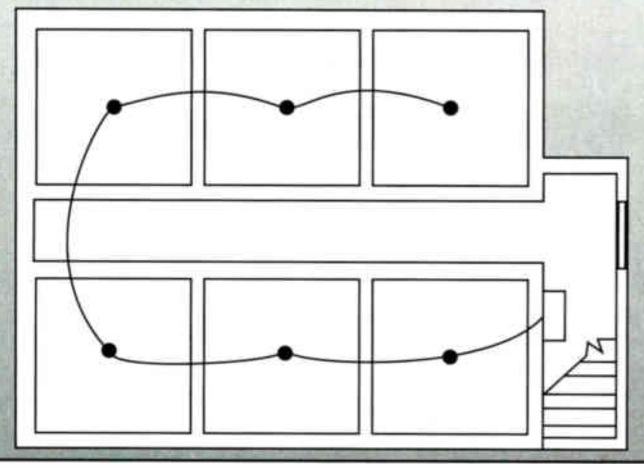
Before beginning, you should check for possible ways to simplify your task and at the same time make the wiring less visible (more secure). Each cable operator has different philosophies and policies on how cables should run in MDUs, so check your plans with your supervisor.

Some of the possibilities for cable routings include the following:

1) *Vacant conduits.* Be sure you have permission to use them first.

2) *Drop ceilings.* When dropped ceil-

Figure 2: Loop-through design



ings are used as air plenums, any wiring usually requires a special jacket material made of Teflon, some other fire-resistant material, or it must be installed in conduit. The material types and drop cable codes have been specified in the *National Electrical Code*, Article 820. Never use poly or PVC jacketed cable for these types of wiring jobs, unless it is enclosed in a conduit. These materials emit toxic fumes when exposed to flame and can support combustion.

3) *Elevator shafts.* It will be necessary to check with your supervisor to determine if local policy or building codes prohibit the use of elevator shafts. Where allowed, the cable must utilize an approved fire resistant jacket or be installed in a noncombustible conduit.

4) *Use of existing wiring from antenna systems.* Make certain that the design of the antenna system complies with your company's standards, and that permission has been granted to use the antenna wiring. In many cases these systems have been constructed with wire that does not have sufficient shielding for CATV use. If you cannot determine by examination of the wiring whether or not the shielding is sufficient, consult with your supervisor.

5) *Molding ducts.* Many types are available. They do a fairly good job of allowing you to conceal wiring in corridors and along baseboards. Security is moderate.

To avoid tampering, these types of ducts should be installed in locations where they are not readily accessible to the residents. For instance, if running molding duct in a hallway, place the duct along the edge of the ceiling out of easy reach. One type of molding duct with cables installed is illustrated in Figure 1 on page 50.

Figure 1 shows a 3-way splitter that will be hidden within the duct work when covered. This is not a recommended procedure since troubleshooting this location at a later date will be difficult because of the hidden device.

While the majority of these ducts have similar installation procedures, there are some minor differences, and you should read and follow the manufacturer's installation instructions for the brand of duct molding you are using.

6) *Outside wiring.* In cases where no other methods are feasible, and where permission can be obtained, it is possible to run outside wiring to each of the units. When doing this, it is important to make every reasonable attempt to hide the

wiring. The use of molding or conduits may be necessary to accomplish this.

In some cases, you may be able to partially conceal the wiring by attaching it next to other wires or pipes, such as down spouts. Never attach it directly to these items, but rather attach to the building as close as legally allowed and physically possible.

In order to keep the wiring neat, it is generally recommended that common routing be used as much as possible. By "common routing" we mean that the wiring should be bundled together as it goes up the side of the building. Feeds to individual units are split off as necessary.

When running the wire bundles and feeds, use straight vertical and horizontal runs and attach the wire securely with fasteners. Never make diagonal cable runs or leave cables loosely attached.

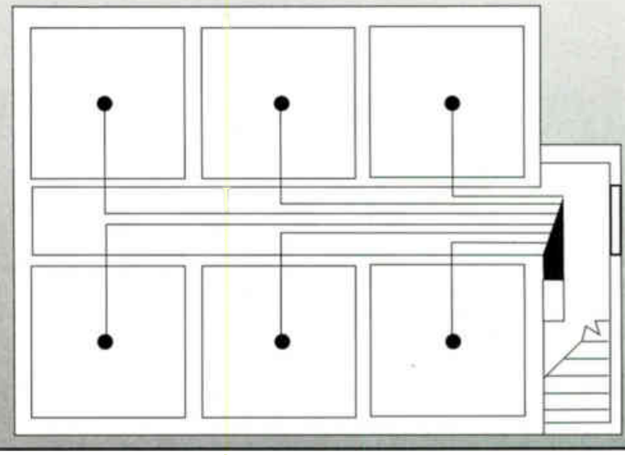
Loop-through vs. home-run

Loop-through and home-run wiring represent two different methods of configuring the inside wiring for MDUs. Figures 2 and 3 illustrate the differences.

Unless there are unusual circumstances involved, the use of loop-through wiring is not recommended because:

- Access to the individual apartment must be gained for maintenance and troubleshooting. Also, you may need to gain access to apartments not affected by a problem in order to correct it.
- Access to the individual apartment must be gained to perform a disconnect or change of service.
- Because of the series nature of the cable circuit, problems and interference generated in one unit can be passed throughout the system to other units.
- Signal security is difficult to achieve.

Figure 3: Home-run wiring



Home-run is the accepted method for MDU wiring by a vast majority of cable system operators today. There are several reasons for this, including:

- Each location can be connected or disconnected from a central location.
- The isolation of each cable to a particular unit prevents problems and interference created by tampering or other circumstances from being transmitted throughout the system to other subscribers in the building.
- In trapped systems, the traps can be located in a remote, secure location, such as a metal lock box. **BTB**

MATV upgrade: Installing a CATV loop-through system

By Jerry Trautwein
President, Dynasty Communications
And Ray Rendoff
Director of Technical Curriculum
National Cable Television Institute

The cable splicer has just finished terminating the last passive device in the 15-story high-rise apartment. Multiple dwelling unit (MDU) interior cabling can now begin. It is important to quality check the physical work completed between the feed point and 15th story terminating point and to take end-of-line readings to complete the first phase of this project.

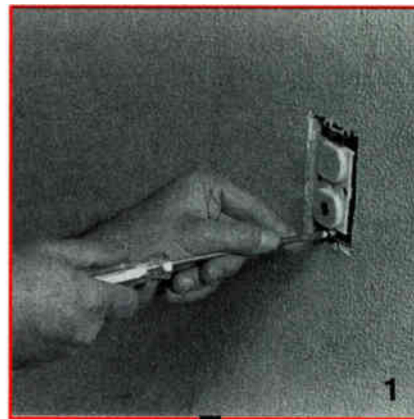
The high cost of exterior cable routing/attachment and a request by the owner to keep all cabling totally concealed prohibits the use of our originally designed and desired home-run system. Therefore, a loop-through system using the existing MATV stacked conduit system that also has an added outlet in each master bedroom will be utilized. Because the existing MATV drop cable is 40 percent copper braid with no shielding, which is unsuitable for CATV applications, it will all be replaced.

The second phase of the project begins when the project manager introduces the working foreman to the on-site building manager and maintenance man. In this case, the maintenance man has been assigned to the crew as our access person. Our company and the MSO both require an access person when any crew member is working in a tenant's unit. A start time each day of 8:30 a.m. has been arranged between the working foreman, building manager and the maintenance man to give the tenants time enough to be up.

While on-site, the project manager and working foreman door hang notices on the apartments containing the half-inch vertical riser (conduit). This conduit contains the MATV drop cable that will be used to pull in new CATV drop cables for all procedures. This work will begin in 48 hours. In this case, the 06 stack. They also will hang a notice on the bulletin board in the lobby describing the type of work that will be performed over the course of the next week and a half to give the tenants additional notice, including phone numbers of people to contact in case any questions arise.

Starting at the top

Forty-eight hours has now elapsed and our crew of three men has met the maintenance person in the lobby and proceeded to the 15th floor. There, the access person and two crew members start the set-up procedure in unit 1506, while the other crewman takes his tools to the 15th floor utility room. The workman in the utility room identifies the 06 half-inch thin-wall conduit protruding from the utility room floor. Later, the remaining eight risers will need to be identified as each new CATV drop cable is pulled in using the existing MATV drop cable. This procedure will take place in each riser, floor to floor, and a master bedroom outlet.



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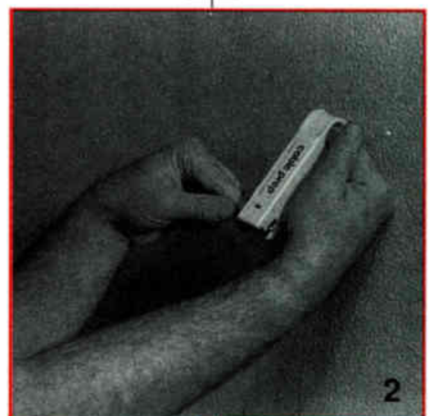

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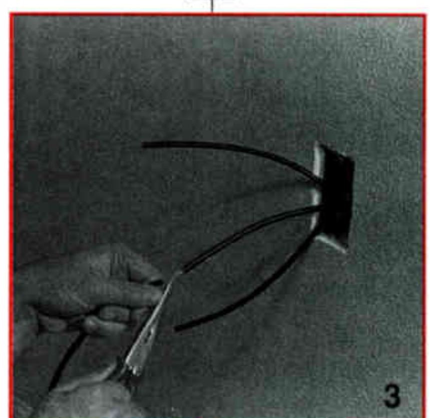

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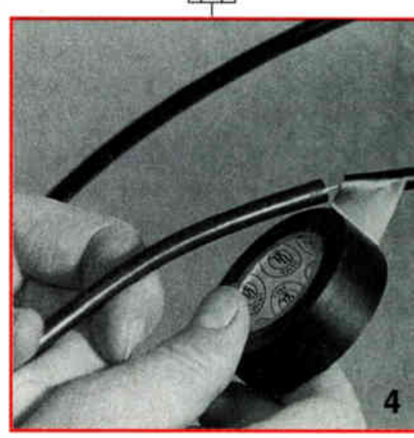

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The crewman removes the primary MATV outlet in the living room of unit 1506. This riser contains one input and two output MATV drop cables that originate, terminate and disperse in unit 1506 (Photo 1). Talking to each other over the hands-free two-way radio, the workmen in the utility room acknowledges that he has identified the input drop by a gentle tug given by the crewman in 1506. The crewman in the living room of unit 1506 disconnects all three leads from the old MATV outlet. He also marks all MATV drops (input and extra outlet in 1506, and feed to 1406), even though it is evident which conduit feeds which outlet opening.

Prior to pulling the existing MATV input drop cable and the next CATV drop input cable from the primary outlet to the utility room, the cable ends are tied together. The center conductor on each cable is exposed 3/4 to 1 inch with a cable preparation tool (Photo 2). The center conductor is bent halfway down on the old and new drops on the exposed conductor forming hooks, which are linked together and crimped with needle nose pliers (Photo 3).

A good quality black electrical tape is first wrapped around the MATV drop input cable just below the conduit and continues down the splice and 3/4 of an inch past the open end of the new CATV cable drop (Photo 4). This is to prevent the tape from backing up or unraveling when pulled into the conduit.

A non-corrosive water base pulling lubricant (such as Dyna-Blue) suited to the jacket of the drop cable is applied to the new CATV drop cable prior to and as it is being pulled into the conduit (Photo 5). The crewman in the living room radios the man in the utility room to start the pull. He pulls 12 to 18 inches of cable at a time until the spliced end of the new CATV drop reaches the utility room. An additional 6 feet of cable is pulled and then cut later to be connected to the output port of the tap that was premounted in the utility room. The crewman in the living room cuts the drop cable from the cable reel, leaving no less than an extra 6 inches of cable at the wall plate opening.

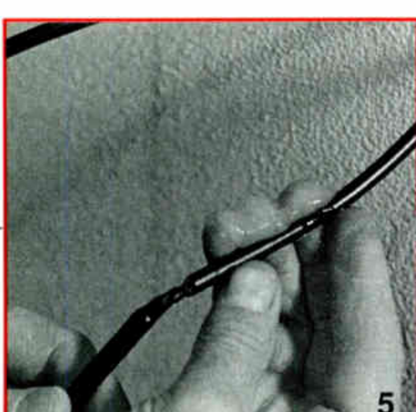
"A request by the owner to keep all cabling totally concealed prohibits the use of our originally designed and desired home-run system."

While the first pull was in progress, the third crewman was disassembling the master bedroom wall plate to prepare for the next pull. The man in the living room prepares the new CATV drop on the reel to attach it to the existing MATV drop and pull them to the master bedroom. The same preparation and pulling procedures are used. The cable reel stand is still set up in the living room to maintain a common feed point. The crewman in the master bedroom pulls on the MATV drop as the crewman in the living room feeds the new CATV drop into the conduit until 6 inches of the new CATV drop protrudes from the wall opening. The crewman in the master bedroom then cuts the MATV drop from the new CATV drop. The crewman in the master bedroom properly prepares the end of the CATV drop cable and installs it with a Gilbert U.S.A. fitting. The **F**-fitting is screwed onto the F-81 fitting on the wall plate and properly torqued into place. Two 6-32 x 1-inch machine screws are properly threaded into the master bedroom wall plate to complete the installation (Photo 6).

The other crew member has been in the 15th floor utility room finishing connecting his CATV drop to the tap port while the new CATV drop was being pulled into the master bedroom of unit 1506 by the other two crewmen. The crewman now leaves the utility room and moves down to the living room of unit 1406. He clears the area around the MATV outlet and then removes the wall plate. The MATV drops are marked and cut loose from the MATV wall plate. The workmen in unit 1506 have finished preparing and lubricating the drop for pulling from the living room outlet in unit 1506 to the living room outlet in unit 1406. The crewman in unit 1506 signals to the crewman in unit 1406. The same pulling and terminating procedures are followed as the crewman in unit 1406 pulls in the new cable. The other two crewmen will start the same repetitive cable preparation and pulling process through the entire stack. The crewmen in unit 1506 will finish the 15-minute connectorization procedure and join the other crewmen to complete the same cable preparation and pulling procedure in units 1406 and 1306.

Final touches

With a pencil, the crewman in the living room of unit 1506 marks the inner parameter of the wall-grabber insert prior to spacing it away from the opposing opening 1-1/2 to 2 inches and at the same distance from the floor as the original MATV wall opening (Photo 7). (Note: Do not cut the opening before identifying which side of the 4-inch square box the support stud is on.) The crewman then takes his keyhole saw out of his tool pouch and saws the new opening in the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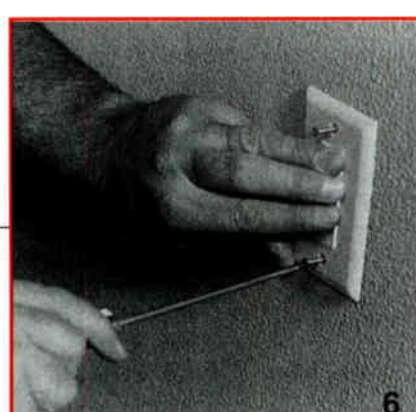
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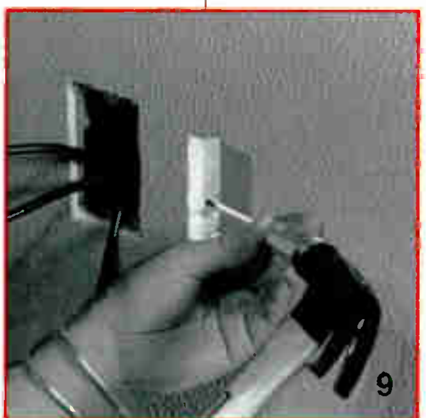

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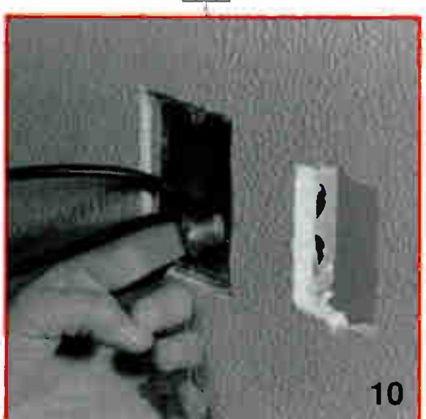

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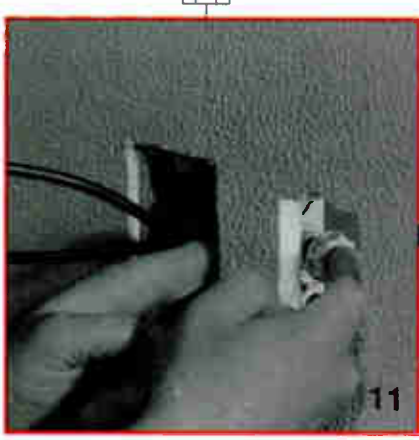
wall, following the penciled outline (Photo 8). He continues by removing the two bottom half-inch knockouts from the 4-inch square box and discards them (Photo 9). He also installs a half-inch threaded chase nipple, which provides a smooth surface for the drop's installation and any future movement (Photo 10). He then installs a half-inch lock ring to secure the chase nipple to the 4-inch square box that accompanies both chase nipple ends with an insulating bushing (Photo 11).

To install the wall-grabber insert, he presses the outer parameter of the rectangular metal surface flush into the wall opening and bends the four tabs over into the opening, one by one, to lock the insert firmly into place (Photo 12). This opening is created for three reasons: 1) lack of space to put the two passive devices; 2) to give all drops enough space to comply with the minimum required bending radius without kinking the drops inside the shallow half-inch deep, 4-inch square box; and 3) additional space to conceal traps if your system is not fully addressable. (Security screws can be installed on the blank wall plate and/or security shield on drop connectors, if desired.)

Prior to installing the necessary passive devices, the crewman in the living room of unit 1506 looks at the elevation print to determine what value of directional coupler (DC) is required. He then removes it, along with a two-way splitter and a pre-cut jumper to go between MATV and CATV wall plate openings (Photo 13) and a handful of F-fittings from his storage box to connectorize the ends of each newly installed CATV drop cable. Now, with a pair of side cutters (diagonal pliers), he notches a sequence of marks in the drops prior to sliding each drop through the half-inch threaded bushing sleeve. This notch system provides a means to identify each drop (Photo 14). The drop in the bottom half-



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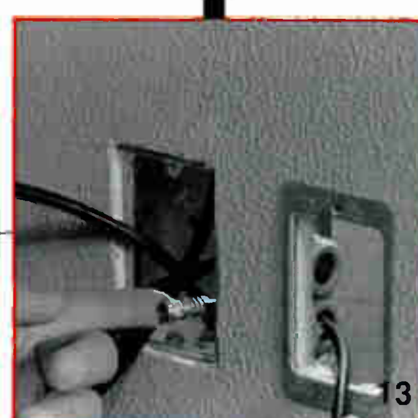

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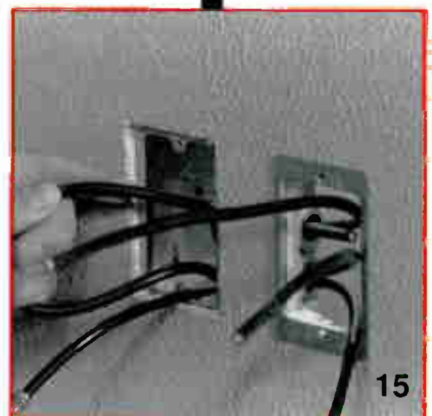

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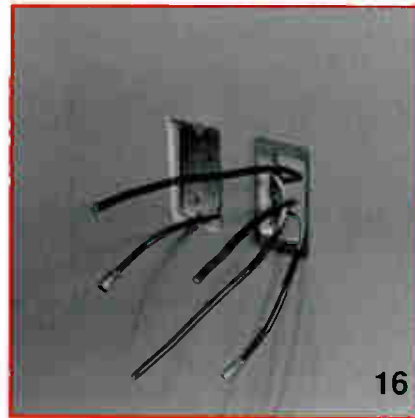

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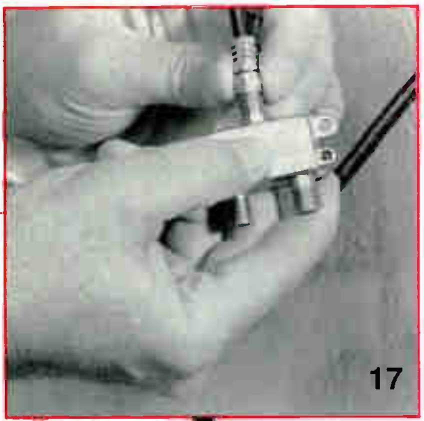

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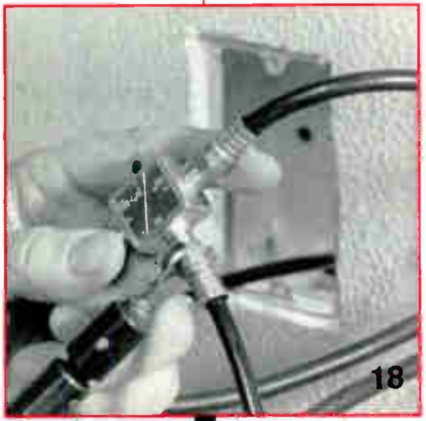

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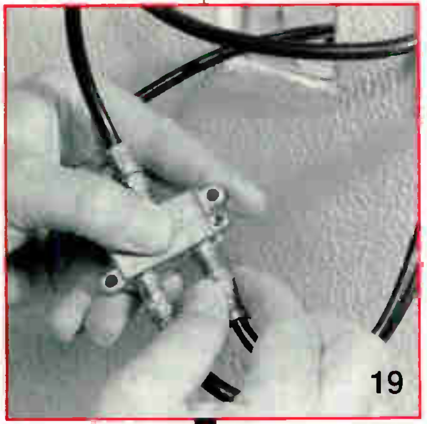

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inch sleeve for the master bedroom outlet is marked with one notch. The jumper cable will be in the same bottom half-inch sleeve. The top half-inch sleeve will contain the input and output drops. The output drop is marked with two notches and installed through the half-inch sleeve (Photo 15). The input drop has no notches for its identification (Photos 16).

Since the drop is active in each stack, the crewman can verify and balance the signal, if necessary, by installing a different value DC. This will help eliminate the necessity of a future service call due to improper signal levels.

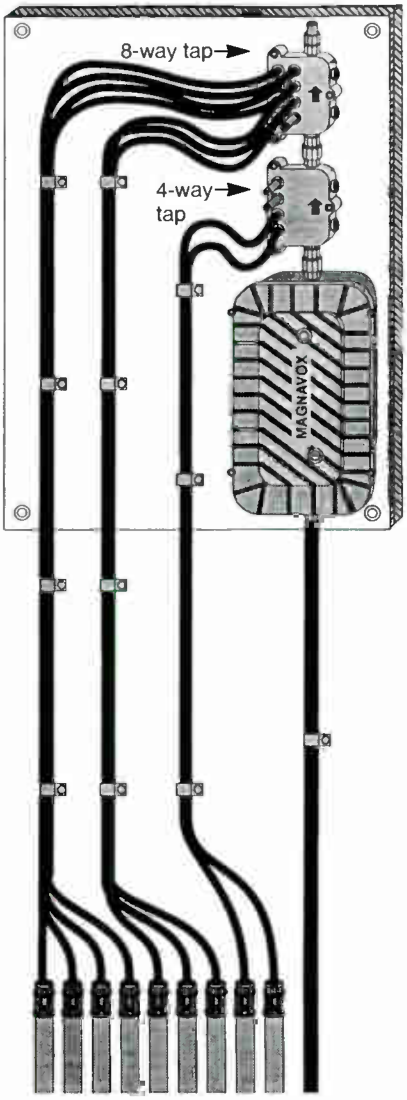
Prior to installing the mini-DC, all drops are prepared and connectorized. An additional small jumper cable is now installed between the DC tap port and the splitter input port (Photo 17). Then the input and two output cable connectors are hand-tightened onto the DC's input, output and tap ports, respectively, and torqued to the manufacturer's recommended specification (Photo 18). Lastly, the master bedroom outlet fitting is hand-tightened on to one of the two-way splitter's output ports and the living room outlet jumper, which was installed earlier, is connected to the other splitter output port (Photo 19). Again, these fittings are torqued to the manufacturer's recommended specification (Photo 20). He double checks the cables and their port connections before gently tucking this drop configuration into the wall void (Photo 21).

To finalize the first unit, the crewman connects the jumper cable fitting to the F-81 barrel connector of the wall plate. He then installs two 6-32 x 1-inch screws through the openings in the blank wall plate to secure it to the wall over the new opening (Photo 22).

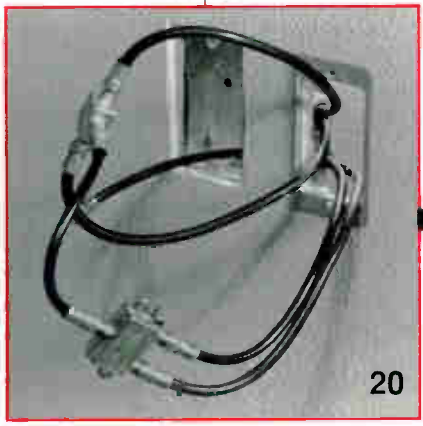
The last (and very important) step performed in the unit is cleaning up any mess with your vacuum cleaner and moving furniture back to its original place.

The crewman now moves his tools

Utility room hookup



and equipment to the 13th floor to keep the pulling process in motion while moving stack by stack with the other crew members until the job is completed in each unit and in the utility room (as shown above). **BTB**



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Cable's fowl beginnings

By Ben Conroy

Would people subscribe to a two-channel cable service? In 1955 in Uvalde, Texas, they would, and did — on a then state-of-the-art three-channel strip system. People in this city of 9,000, located about 85 miles west of San Antonio, received their only television then from San Antonio Chs. 4 and 5 on antennas mounted on 50-foot masts or wooden poles. (Some used 80- to 100-foot towers.) Off-air reception was spotty. Depending on the weather, quality ranged from fair to deep snow, with lovely co-channel coming in from Chs. 4 and 5 everywhere: Dallas, the Rio Grande Valley, West Palm Beach, Fla., wherever!

Uvalde, then, was my debut into cable TV, which was called community antenna television (CATV). There were about 3,000 households in the city and an antenna count showed that 535 people owned TV sets.

Will it work?

It's interesting to contrast the 1992 attitude toward cable TV, now a household term, with that of 1955 when reception by cable was generally unknown. "This thing can't work," I was repeatedly told, "Who ever heard of getting television over a wire?" In fact, when our 400-foot tower went up, the local paper ran a picture of it captioned: "Will it work?"

The appearance of the tower brought several complaints to the effect that, since it was erected, TV reception was worse than ever because "that (blank blank) tower sucks all the signal out of the air." I suspect that rumor was started by a couple of TV dealers who apparently made more money from selling/installing antennas than from sales of TV sets.

But it did work, and people did hook up to the cable, with lingering resentment by some that they had to pay for television, unlike those living closer to San Antonio. Die-hard TV viewers signed up early and were impatient during our construction period for the cable to get to their block. We ran optimistic ads with maps in the paper with conservative dates for service availability in given areas.

Once in business with paying customers, the fun started — particularly in spring when co-channel interference was at its worst. It even wiped out good cable reception at times. Trying to explain this to irate customers who were paying for good reception was great sport. Sometimes during dinner, my wife and I just kept the phone on the table to chat with callers and explain. One of the best responses I recall using was saying to the customer that he could help me overcome this vexing problem. "How?" asked the customer. I said repeat after me, "Our Father, who art in heaven ..."

Cable birds — not what you think

Although cable was a better mousetrap, not everybody beat a path to our door. Once the early rush of connections was over, it was then a selling job with one promotion after another, including my going door-to-door to the homes with antennas. We took antenna trades to offset some of the connection charge. At Christmas time, we'd run a toy promotion by allowing would-be subscribers to bring in a usable toy for the hookup fee. The toys were turned over to the Kiwanis Club.

I recall one promotion we used to induce Hispanics (about 45-50 percent of households) to connect. Many of them raised chickens in their backyards, so we ran ads in Spanish over the radio that a dressed chicken brought to the cable office would get them hooked up. Well, we had boxes and boxes and boxes of these birds in the office and a load of new cable customers. Talk about sophisticated marketing techniques! I can't recall where all the chickens went (many of them were tough old hens).

Another incident not related to customers occurred in southwest Texas. You saw a lot of buzzards flying around, particularly over ranch land. Our tower was on a hill in a ranch pasture and buzzards often would roost on our antennas. These are big old birds and enough of them on antennas will weaken, bend or break antenna elements. We tried a variety of remedies — noise, gunfire (but not at the antennas!), etc., with no lasting effect. In any case, we couldn't be there all the time.

"I was repeatedly told, 'Who ever heard of getting television over a wire?' "

Finally, Faber Spires, my chief tech, came up with an idea that did work. He found an old Navy speaker, mounted it on top of the tower, wired it to the audio of San Antonio's new third channel (the ABC network) because its programming included lots of western shoot 'em ups and gunfire. He cranked the audio way up and left it on. No more buzzard roosting!

We ran an ad headed: "Hi-Fi for Buzzards" as a promotion gimmick and sent a tear-sheet of the ad to the station people (whom I knew well) with an explanation. As a new station, they were doing their own promotions for viewers. The station ran a news item on it (welcoming Uvalde cable viewers), and the next thing we knew, a story came down The Associated Press wires about the hi-fi for buz-

Reader Service Number 43

zards in Uvalde and the use to which ABC's Westerns were being put.

Early telco, broadcast wars

I have many other memories of those days. Around 1958, AT&T and the Bell companies began getting horsy with their new pole attachment contracts. My first knowledge of this was when Tom Witt and a group proposed to build a system in Eagle Pass (a city on the Mexican border about 65 miles southeast of Uvalde) and applied for pole contracts. The power company posed no problem, but Southwestern Bell's contract provided (among other things): the cable system could carry only broadcast TV signals and no pay TV could be carried; there could be no origination of video or audio material; and the system had to be sold to Bell after five years for its depreciated value. Tom responded by setting his own poles next to telco poles where needed.

This foreshadowed a 1962 situation when Jack Crosby and I sought to build a system in Effingham, Ill. Neither the power company nor the telephone company (independent) would even discuss pole contracts, so we set our own poles. It was far cheaper in the long run.

In 1960, shortly after the Texas Cable TV Association was organized, we received a letter from the executive director of the Texas Association of Broadcasters inviting our new association to join TAB as an associate member, and inviting our officers to attend the annual meeting in Austin that year.

So, Johnny Mankin of Tyler, Jack Crosby of Del Rio and I duly attended, attended sessions, toured the "hostility" suites, greeted people and generally showed the flag. Once our presence became known, there was a noticeable chill in the initially cordial atmosphere on the part of some of the broadcasters, notably Marshall Pengra of Tyler and Vann Kennedy of Corpus Christi, among others. It was an embarrassed executive director who later had to dis-invite us from the TAB. So it was a short-lived romance, although many Texas broadcasters eventually got into cable.

An ironic follow-up to the TAB story occurred 20 years later in 1980 when I was an applicant for a franchise in Pleasanton, 30 miles south of San Antonio. One of the competing groups included the mayor's son (who was one of the principals) and my old friend, the former executive director of the TAB (who was now a PR man and entrepreneur of sorts). He and I had an amiable chat while waiting for the city clerk to notify us the City Council had awarded the franchise to my group. What goes around, comes **CT**

Ben Conroy founded Uvalde Television Cable Corp. in 1955, and Effingham TV Cable Co. in 1962. Later he was president and director of Cotulla Cable TV in Texas, director of Oxford Cable Co., in Maine, and vice president and director of General Communications and Entertainment, which operated CATV systems in Maryland, Illinois, Colorado, Wyoming and New Mexico. Other CATV ventures included involvement in Communications Properties Inc., Conroy Management Services Inc., and several other Texas cable TV firms. He has held key positions in the National Cable Television Association, Texas Cable Television Association and the National Museum of Cable TV.

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CableLabs tests network for industrywide benchmarking

Table 1: Sample report (with your values filled in)

Service area	Performance measure	No. systems reporting	Your score (percentile)	Results: Lowest	First quarter (25%)	Middle (50%)	Third quarter (75%)	Highest
Repair service	1. Truck rolls/ month/1,000 subs	384	23 (51%)	4	11	22	32	44
Customer service	8. Avg. time (seconds) to answer phone	541	7 (62%)	4	5	6	8	12
Overall service	28. Overall system performance	839	44 (27%)	21	42	58	80	86

Two new tools for cable system management — industrywide benchmarking and an on-line information service — are being developed and tested by CableLabs. The two-pronged test, to last about 10 months, stems directly from earlier work commissioned by CableLabs' Optimized Systems Operation Task Force and conducted by the Westinghouse Science and Tech Center of Pittsburgh.

In a project phase completed in April, Westinghouse researchers defined five major "challenges" or opportunities for improvement in cable system operations, then suggested seven possible "interventions" to solve those problems. The macro-level goal of the entire project is twofold: improved customer satisfaction and better performance for MSOs.

The five challenges defined by the Westinghouse researchers, relying on industry data as well as CableLabs' input, were reported in a CableLabs document, "Optimized Systems Operations: Interventions To Improve Customer Satisfaction," published in April. They are:

- Technology support — providing workers with tools to improve their performance.
- Training — raising workers' skill levels.
- Decision aids — tools to help management make better analyses of various benefit/cost trade-offs.
- Customer education — creating better-informed subscribers with more realistic expectations of cable.
- Performance measurement — indices to help individual systems and MSOs compare their performance with that of the entire industry.

Then, the Westinghouse team identified these seven possible interventions to address those challenges:

- Automated line monitoring and testing
- Benchmarking
- Decision analysis
- Equipment and component tracking
- An on-line information system
- Training
- A "total quality" program

Of these seven, it was agreed to proceed next with demonstrations of the two projects — benchmarking and on-line information system (OLIS) interventions. These two projects now are proceeding along parallel paths under the direction of a single CableLabs advisory committee.

Each has begun with a six-month phase devoted to designing and building a system. Some changes and enhancements are expected during this six-month period. By mid-August, five MSOs (representing 30 systems) were selected to participate.

Then, the OLIS and benchmarking systems are expected to work in a final four-month test phase, which is expected to yield more useful data. Also, the systems will be demonstrated to other industry cable operators and there will be discussions about their possible long-term adoption industrywide.

Table 2: On-line information system's top level menu

Make selection

1. Training data base
2. Consumer education data base
3. Community perception data base
4. Product information data base
5. Benchmarking
6. CableLabs project summaries
7. Messaging
8. Electronic mail
9. Help

Benchmarking

Generically, benchmarking involves breaking a process down into identifiable elements, compiling performance data for each of those elements, then comparing data for one operating unit with a larger base of companywide, industrywide or multi-industry data.

Benchmarking is widely used in many industries as a tool for improving product or service quality, noted Scott Bachman, CableLabs' director of technical operations projects, who is heading up the two 10-month projects. Several cable MSOs already compile system-level benchmark data and use it to improve performance, Bachman noted. But very little benchmarking is yet being done industrywide.

In the new project, participating cable systems will fill in a PC-based electronic form that asks them for data on approximately 15 carefully defined performance criteria. The criteria haven't been fully defined, but the April CableLabs document lists about a dozen possible ones, ranging from "average time (seconds) to answer telephone" to "truck rolls per month per 1,000 subscribers" to "percent of time devoted to technical training." Each system will need a sufficiently powered PC (running Microsoft Windows) or an Apple Macintosh, plus a suitable modem. Computer costs are expected to be low, since many systems will already have the necessary computers and modems.

Systems will send their data via modem monthly to the PC of an outside contractor acting as system coordinator.

This information will be kept confidential and will be aggregated and redistributed (again, by modem) to the individual systems. The coordinator will rely largely on off-the-shelf software such as a standard spreadsheet or relational data base package for data collection, and Westinghouse's WESCAT communications software package.

CableLabs and MSO engineers have put great emphasis on data security. The system coordinator's software has been designed so that it is unable to identify the sender of a particular data transmission, other than as a member of a particular general category of systems (e.g., large or small, classic or new-build). The incoming data will be sorted simply by having systems transmit to different electronic mailboxes (e.g., all the small/classic systems dialing in to one mailbox, etc.).

The data will be received from all systems by a certain date and time each month, then aggregated overnight into all-system totals and subtotals for each of four subcategories. These aggregate numbers will then be modemed back to the systems' computers. All comparisons of an individual system's performance against global benchmarks will be compiled only in that system's computer, using specialized software provided by the system coordinator.

A sample of the data that would be seen by an individual system operator, comparing his/her system's performance with a larger universe, is shown in Table 1. Systems can see how they measure up against other systems both in raw numbers and in quartile scores.

The potential benefits of the benchmarking project will come when system managers use the numbers as a tool to achieve better performance, the report notes. Thanks to the use of PCs, modems and monthly transmissions, data will be timely enough to be effectively used in tracking performance and, where necessary, taking remedial steps, said Bachman.

On-line information service

On-line networks have been used effectively in industry segments ranging from light bulb manufacturing to nuclear power plant operations, the Westinghouse researchers write. The OLIS can use a variety of communications carriers as an intermediary in the intercomputer communications. System operators will be able to dial into a network at no cost using either a local network node or an 800 number.

Although benchmark data will be the first content communicated on the OLIS, the Westinghouse researchers also noted other content it could carry, including:

- Bulletin boards providing such things as product information, training materials and summaries of CableLabs projects.
- Messaging or electronic mail — an alternative to telephones, faxes or overnight mail for rapid delivery of hard-copy documents.
- News reports about developments in cable and related industries, compiled by keyword searches of news services that are readily available on-line.

A sample design for the OLIS's top-level menu is shown in Table 2.

Industrywide rollout?

Under the current timetable, intensive development of both the benchmarking system and the OLIS will continue through October. Then, both systems will be in increasingly stable operation (and gathering useful data) from about November 1992 to April 1993.

During the project's final six-month phase, CableLabs and industry MSOs will decide whether to keep the two systems going. If the idea catches on, the cable TV industry may have its first industrywide benchmarking system, as well as an on-line network usable for other purposes. **CT**

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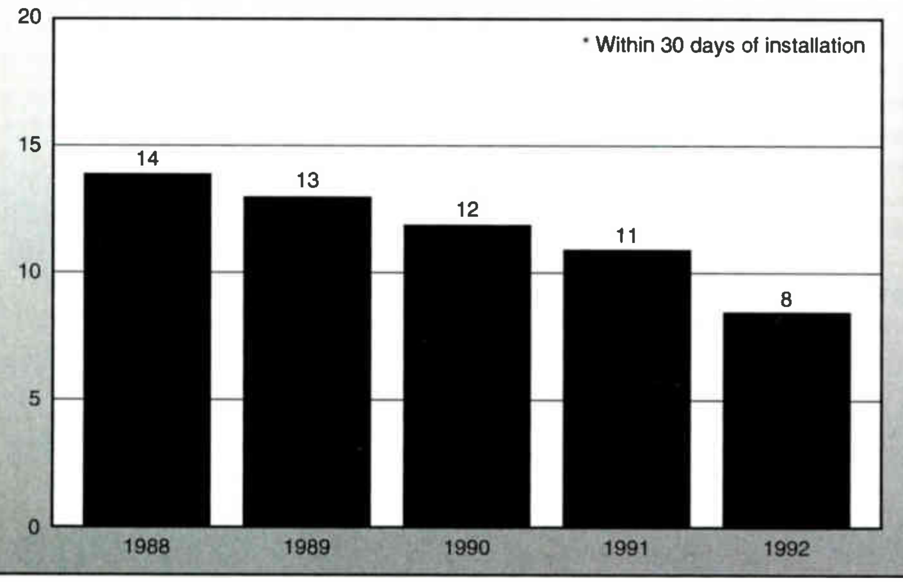
Figure 2: Percent of return trips*



"Laser-aimed" training

(Continued from page 28)

duces exactly the result specified.

An example of how the best intentions can go wrong occurred in a company that provided desk-top computers for all its office employees. The reason for doing so was to achieve greater office efficiency. To make this possible, the company sponsored a computer training program for all employees. The course included an overview of computers, the basic functions of the CPU/RAM, and how the computer interfaces with the printer and modems, etc.

As you probably can guess, the employees of the company were not able to make much use of the new equipment. Aside from turning it on, they had little to no information applicable to how they could use it as a tool in their work. Although some would argue that it was "nice to know," the time and money spent on the training was wasted. The program did not meet the company's business need to help employees use their computer effectively. And the program failed to meet the employees' needs. Even though they could say they "learned a lot," they were frustrated by the lack of applicability.

As shown in Figure 1 (page 28), the ISD method consists of a five-step approach (sometimes more, depending on the delivery method). The first step carefully identifies the business objectives and general scope of the training to be developed. Then the audience is defined by education, experience, time on the job and basically anything that will help to match the delivery of the course to those receiving the training.

Next, a task analysis is conducted. First a thorough cataloging of the actual tasks or competencies to be considered in the training takes place, followed by a detailed analysis of the tasks themselves to break out all the skills and or the behaviors associated with those tasks.

The design of the course comes next. Here the skill type (such as a manual task, a mathematical computation, etc.) is matched up with one of a dozen different presentation techniques, specifically intended to deliver that particular information in the most expedient way. At this point, the method of appreciating each of the skills taught is identified and is included as part of the learning and course assessment objectives.

The development phase incorporates expert information needed to develop each part of the course. The subject matter expert is a credible expert called upon to provide the real "meat" of the information to be taught. This information is then written or integrated into the various delivery media, as dictated in the design phase.

"The proof of the pudding," as well as the key to the ISD process, is the validation phase. In validation, the material and delivery media is given the "acid test": If the information delivered results in the learner's ability to perform or behave according to the intended objectives, then the delivery of the information is a success. If not, a reassessment of the objectives, the audience, the information, etc., is conducted to find and correct the fault(s). If, as a result of their training in the example mentioned previously, the office employees were then capable of greater efficiency by way of being able to perform their tasks with their computers, the training would have been a success. However, in this case, the training program was doomed before it got started.

Reinforcement and acknowledgment

If there is a lack of reinforcement for the training by the management, most of the resources expended will be wasted. A serious management error is to assume that training is limited to the teaching phase. If the skills and behaviors learned are to be used, they must be routinely evaluated and acknowledged. Management role models are essential to assuring the employees use the skills and behaviors learned.

In a 1979 study by Rackham for the Xerox Corp., it was discovered that 87 percent of the newly learned skills were soon lost without follow-up coaching and reinforcement. If an employee is trained in constructing the proper drop installation, but is never evaluated on "how," but "how many," the skills and behaviors learned in training will give way to "shortcuts" that are, in effect, being reinforced.

Training assessment

Is the training program working? This is the question that management must evaluate routinely. The employees can provide the bulk of the answers. Given the specific question: "Did the training you received teach you to make all the customer connections?" The answer will give several clues about the training. For example:

- If the training program was designed back before VCRs were in wide use, and the converter was the extent of the hook-up complexity, the answer to the question (at that time) would likely be "yes." However, as the technology and complexity of the customer equipment evolved and the cable company's business began to include audio hook-ups, the answer to the same question would, by now, be "no." In this case, the problem lies with the training failing to keep pace with the skills needed by the employee to do the job.
- If there is only an isolated case of an individual unable to demonstrate the skills taught, further training for that

person may be needed. If there is an inability of the entire work force to demonstrate a particular skill, the problem may be the instructor, an omission in the course, a new skill not yet addressed by the training, or it may be a skill lost because of the lack of practice or management reinforcement.

If there is no post-training or routine skills assessment of the employees by management, and by chance a skills issue comes up with an individual employee, the management is in the embarrassing situation of not knowing where the problem lies. Isolating the problem, after the fact, can only take place after a complete assessment of the training. And, at any rate, part of the findings will show a lack of management reinforcement.

Roll-out

Using the ISD format, Cox developed the initial installment of its technical training program. The program begins with the entry-level employee and drop installation, and ends with the operation and verification of the CATV plant parameters. The program was developed in three phases and the first phase became available to the systems in January 1991.

Due to the unique requirements of each location, the program anticipates and encourages the system to make modifications (within technical and safety limitations) in order to maximize the benefits.

Cox Cable Cleveland consolidated the positions of installer, service and maintenance technician job duties/tasks into multispecialized area technical representatives (ATRs). This was done to meet the needs of our customers by conducting only one visit to their home. Cox Cleveland also is addressing employee turnover rate and providing career nurturing through the investment in the training program.

Implementation and adjustment

Initially, class size was to average between 10 and 15 ATRs. Lessons were scheduled for 1 to 1-1/2 hours, with all field personnel receiving training once per week. Problems quickly became apparent with this plan. Instruction became difficult because of the various levels of expertise. Some ATRs were not asking questions or participating, which resulted in the delivery becoming more "lecture" than interactive. After an early training review and assessment, the delivery was restructured into one-on-one sessions. This provided a tailored program where students did not hesitate to ask questions.

Augmenting the classroom training, each ATR also would spend two days on the job with his or her immediate lead ATR there for coaching. Initially, it was felt this type of on the job training might become cost-prohibitive, but the system realized great rewards in the investment.

Performance management (reinforcement)

The management takes a very active role in reinforcing the training. The essential skills and behaviors for each job taught in the training course are specifically laid out in a document called the "Job Skills Checklist" (JSC). Each item on the JSC is a clearly observable task or skill that allows easy assessment of the skill or behavior learned: "Demonstrate the proper installation of an F-fitting," or "Beginning at the pole, describe the clearances you must maintain or consider when installing the drop" (as examples). In fact, the JSC describes the objectives of the training program — the "training standard" if you will.

Each ATR receives a quarterly evaluation and an assessment against the JSC. Thirty percent of the employee's performance evaluation is based on that JSC assessment. If there are deficiencies uncovered, an action plan is devised for the individual and his or her lead ATR to target those issues.

Benefits to the employees

A post-training questionnaire/evaluation was distributed and filled out by all ATRs who completed the program. Management wanted to make sure employees felt that this training program was beneficial. Their comments confirm the training was on target with their needs, the material applied to the job and that they are now able to complete specific tasks more efficiently. Said one ATR, "It puts everyone on the same level of understanding." Another commented, "I like the fact that the material for the training was gathered by Cox personnel and our systems. This keeps us more in tune to what we really have for equipment, how it is actually used, by people who really work for us."

Benefits to customers and Cox

We believe our training has helped by giving consistent information to our customers. Moreover, with an ongoing training and assessment program, all ATRs are on the "same page" with regard to standardized methods and procedures.

Since completing this training, the Cox Cable Cleveland ATRs have increased their production by an average of 12 percent. As a result, the system no longer relies on subcontractors to supplement the workload. The ATRs are forsaking single-focused objectives in favor of becoming more comprehensive.

One of the symptoms of limited opportunities for employees to learn and advance is reflected in employee turnover. As a result of the training, the Cleveland system now has a much lower ATR turnover rate.

One of the most important attributes of technical training in Cleveland is the steady downward trend in the overall percentage of return trips. (See Figure 2.) This is reflected in both installation and repair service calls. The year-to-year rate of reduction was between 8 and 9 percent per year, for the three years preceding the current ISD-formatted technical training program. After the new program was launched in early '91, the data showed a remarkable 27 percent reduction in return trips, year-to-year. (Way to go, Cleveland!)

Strategic planning

The CATV industry is over 40 years old and we are just now giving training its proper priority. Fiber optics, high definition TV, direct broadcast satellites, multichannel microwave distribution systems, two-way voice and data, and personal communications networks are just some of the technologies being actively explored today. Can we wait another 40 years before we establish proper training in the new technologies and still hope to be competitive?

A real hedge against losing to the competition may well be the ability to respond quickly to the new technologies before someone else does. Therefore, any reasonable strategic plan must provide for the training required to make it possible. In view of the challenges and opportunities we already see on the horizon, when would be a better time to put in a formal technical training program? **CT**

Reference

Training for Impact, Dana Gaines Robinson and James C. Robinson.

Tone detection

Noyes Fiber Systems now offers the OFI 200 and OLS2-1300 along with accessories for tone identification on dark fibers. When the OLS2-1300 laser source is modulated (2 kHz) from the central office, the signal will be detected by the OFI 200 optical fiber identifier at remote splice locations or cutover points within the fiber network. The kit is packaged for rugged field use.
Reader service #208

Measurement system

Tektronix unveiled the CMP500 cable TV measurement package. According to the company, it is the first complete system for cable environments, performs tests for all Federal Communications Commission-required measurements in both baseband video and RF, and performs a number of additional tests recommended to ensure high picture quality.

The package provides completely automated measurement and monitoring of in-service and RF signal parameters. Out-of-service measurements are semiautomated, giving operators screen-selectable prompts for directing system activities.

In conjunction with the hardware, the company also has announced CSS500 system software, an instrument control package based on Microsoft Windows. When installed on a personal computer, CSS500 software provides point-and-click operation of measurement functions and graphical display of test results.

The package consists of the Tektronix VM700A automated measurement set, the 2714 cable TV spectrum analyzer, 1450-1 demodulator mainframe and the recently announced TDC-10 tunable down converter. Cables and GPIB and video boards for a PC are available as options. An MS DOS-compatible PC is required but not included in the system, giving users their choice of platform.
Reader service #180

Cleaning solution

American Polywater introduced CableWash, a mild water-based solution used to clean cable jackets before stripping and splicing. The 16-ounce CableWash reservoir bottle feeds cleaning fluid to the CableScrubber bristle head when attached, removing dirt, clay, sand, mud and other underground deposits from cable jackets. The solution is compatible with cable jackets, biodegradable and non-freezing to -5° F. The company says it is more effective than water alone and helps avoid unnecessary solvent use and ground contamination.
Reader service #206

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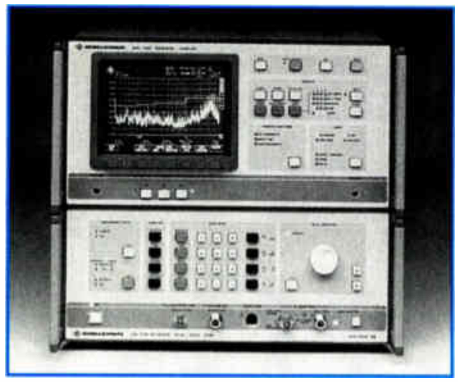
PS Form 3526, January 1991

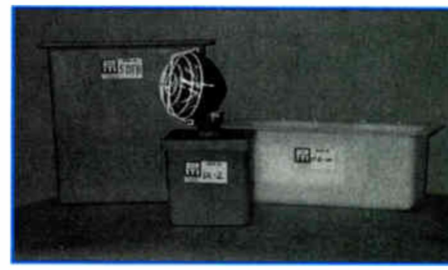
Test receiver

Rohde & Schwarz's new Model ESBI combines the performance of an EMI test receiver with that of a spectrum analyzer to simplify measurements. Made for all EMI measurements, it features a 20 Hz to 5 GHz frequency range, high sensitivity, large dynamic range and weighted measurements of interference pulses. Its extended frequency range also protects against obsolescence from changing EMC standards.



The unit offers max-peak, min-peak, analog average, RMS and quasi-peak detectors with parallel detection capabilities. An integral preselector provides a large dynamic range for wideband signals; a selectable, low-noise preamplifier provides increased sensitivity. Transducer correction factors can be entered in up to four transducer tables, and subsequent measurements are automatically corrected to reflect these factors. Integral AM and FM demodulators facilitate identification of the type of interference and enable measurement of modulation depth, frequency deviation and center frequency offset of selected signals. Sine and pulse calibrators and a tracking generator are built in. An integral spectrum analyzer provides complete scalar network analysis capability.

Reader service #204



Bucket tray and light

The new polyethylene tool trays by Plastic Techniques Inc. are made to fit any aerial lift bucket truck. The trays provide a safe and convenient storage space for tools and CATV meters.

The new UL-2 battery-powered emergency light features a sealed beam with both spot and flood functions, and runs on a standard 7.5 V battery. The light, which can swivel 360°, is available with an optional shatter guard and/or rechargeable battery.

Reader service #205

Fusion splicer

The new FSM-20RS-12 mass fiber fusion splicer from Alcoa Fujikura Ltd. produces low-loss splices on single-mode or multimode fiber-optic cables containing up to 12 fibers of 125/250 µm.

The unit is designed for high-speed mass splicing of fibers arranged in bundled or ribbon-configuration cables. An optional tool arranges bundled fibers into ribbon format for immediate insertion into the fiber holders.

It operates on 85 to 265 VAC or 10 to 15 VDC power sources. Built-in atmospheric pressure compensation permits the splicer to be used at various altitudes without adjusting its operating parameters.

Reader service #207

CALENDAR

November

3-5: Philips mobile training center seminar, Bangor, Maine. Contact Patricia Morgenstern, (800) 448-5171 (outside New York state) or (800) 522-7464 (in New York).

4: SCTE Penn-Ohio Chapter seminar, Installer exams to be administered, Pittsburgh. Contact Marianne McClain, (412) 531-5710.

4: Tektronix seminar, how to evaluate your system, Crystal City Marriott, Washington, D.C. Contact Kathy Richards, (503) 627-1555.

5: SCTE Ohio Valley Chapter seminar, opportunities in telephony for the cable operator, and Installer and BCT/E exams to be administered in all categories at both levels. Reynoldsburg, Ohio. Contact Jon Ludi, (513) 435-2092.

5: SCTE Upper Valley Chapter seminar, video processing, Holiday Inn, White River Junction, Vt. Contact Matthew Alldredge, (802) 885-9317.

6: Tektronix seminar, how to evaluate your system, Adams Mark, Philadelphia. Contact Kathy Richards, (503) 627-1555.

7: SCTE Rocky Mountain Chapter seminar, Installer exams to be administered. Contact Patrick Kelley, (303) 267-4739.

8-9: SCTE Old Dominion Chapter annual membership meeting, elections to be held, and Installer and BCT/E exams to be administered in all categories at both levels (Nov. 8), Holiday Inn, Richmond, Va. Contact Margaret Davison, (703) 248-3400.

9: SCTE Magnolia Chapter seminar, BCT/E Category IV, Ramada Coliseum, Jackson, Miss. Contact Steven Christopher, (601) 824-0200.

10: SCTE Badger State Chapter seminar, effective system sweeping, Holiday Inn, Fond Du Lac, Wis. Contact Gary Wesa, (414) 496-2040.

10: SCTE Central Indiana Chapter seminar, BCT/E exams to be administered in all categories at both levels. Contact Gregg Nydegger, (219) 583-6467.

10: SCTE New York City Chapter seminar, what's flying — PCN, digital compression and commercial insertion. Contact Rich Fevola, (516) 678-7200.

10: SCTE Sierra Chapter seminar, new FCC proof of performance requirements and compliance, Community Center, Roseville, Calif. Contact Rocco, (916) 354-3500.

10: SCTE Wheat State Chapter seminar, new FCC regulations affecting headends and subscriber levels. Contact Lisa Hewitt, (316) 262-4270, ext. 191.

10: SCTE Delmarva Meeting Group seminar, fiber optics, fiber construction and signal level meters, Dover Sheraton, Dover, Del. Contact Linc Reed-Nickerson, (215) 825-6400.

10-12: Philips mobile training center seminar, Syracuse, N.Y. Contact Patricia Morgenstern, (800) 448-5171 (outside New York state) or (800) 522-7464 (in New York).

11: SCTE Appalachian Mid-Atlantic Chapter annual business meeting with election of officers to be held, Holiday Inn, Chambersburg, Pa. Contact Richard Ginter, (814) 672-5393.

11: SCTE Great Plains Chapter seminar, basic troubleshooting, The Knolls Restaurant, Lincoln, Neb. Contact Jennifer Hayes, (402) 334-2336.

11: SCTE Greater Chicago Chapter seminar, professional customer relations, Willowbrook Holiday Inn, Willowbrook, Ill. Contact Bill Whicher, (708) 362-6110.

11: SCTE Magnolia Chapter seminar, Ramada Inn Coliseum, Jackson, Miss. Contact Steven Christopher, (601) 824-0200.

11: SCTE Mid-South Chapter seminar, distribution systems, Ramada Inn, Memphis, Tenn. Contact Scott Young, (901) 365-1770, ext. 107.

11: SCTE North Country Chapter seminar, Sheraton Midway Hotel, St. Paul, Minn. Contact Bill Davis, (612) 646-8755.

11: SCTE Oklahoma Chapter seminar, first aid/CPR. Contact Arturo Amaton, (405) 353-2250.

11: SCTE Palmetto Chapter seminar, audio and video signals and measurements, spectrum analyzer usage, University of South Carolina, Columbia, S.C. Contact John Frierson, (803) 777-5846.

11: SCTE Piedmont Chapter annual membership meeting and election of board, safety and utility locating services. Greensboro, N.C. Contact Tod Dean, (919) 662-1489.

11: SCTE Hawaii Chapter seminar, BCT/E exams to be administered. Contact Michael Goodish, (800) 836-2888.

11-13: Private Cable Show, Marriott at Sawgrass Resort, Ponte Vedra Beach, Fla. Contact (713) 342-9826.

12: SCTE Lake Michigan Chapter seminar, grounding and powering, and safety, Days Inn, Grand Rapids, Mich. Contact Karen Briggs, (616) 947-1491.

12: SCTE Penn-Ohio Chapter seminar, video and audio tests and measurements, distortions and signal processing, Installer exams to be administered, Sheraton Hotel, Warrendale, Pa. Contact Marianne McClain, (412) 531-5710.

12: SCTE Piedmont Chapter seminar, BCT/E exams to be administered at both levels in categories I, II, VI and VII, Winston Salem, N.C. Contact Tod Dean, (919) 662-1489.

12: SCTE West Virginia Mountaineer Chapter seminar, OSHA safety, Elk River Town Center Inn, Charleston, W.Va. Contact Joseph Jarrell, (304) 522-8226.

12: SCTE Satellite Tele-Seminar Program, *A Look Back: The Birth of Broadband Communications* from Cable-Tec Expo '91, to air from 2:30 to 3:30 p.m. ET on Transponder 14 of Galaxy I.

12, 16, 17: SCTE Wheat State Chapter seminar, BCT/E exams to be administered in all categories at both levels, Wichita, Kan. Contact Lisa Hewitt, (316) 262-4270, ext. 191.

13: SCTE West Virginia Mountaineer Chapter seminar, OSHA safety, Holiday Inn, Fairmont, W.Va. Contact Joseph Jarrell, (304) 522-8226.

14: SCTE Chaparral Chapter seminar, TVROs and BCT/E Categories III, "Transportation Systems" and IV, "Distribution Systems," and BCT/E exams to be administered at both levels in all categories, Albuquerque, N.M. Contact Rita Erickson, (505) 761-6206.

14: SCTE Wyoming Chapter seminar, Laramie, Wyo. Contact Stan Olson Sr., (307) 347-3244.

16: SCTE Central Illinois Chapter seminar, BCT/E exams to be administered in Categories II and VII at the technician level; and in Categories II, III and IV at the engineer level, UAE, Decatur, Ill. Contact Chuck Prosser, (309) 347-7071.

16-17: Scientific-Atlanta seminar, distribution, Portland, Ore. Contact Bridget Lanham, (404) 903-5516.

17: SCTE West Virginia Mountaineer Chapter seminar, OSHA safety, Ramada Inn, Charleston, W.Va. Contact Joseph Jarrell, (304) 522-8226.

17: SCTE Pocono Mountain Meeting Group seminar, proof of performance, test measurements and compliance with FCC, Hazleton Holiday Inn, Hazleton, Pa. Contact Anthony Brophy, (717) 462-1911.

18: SCTE Dakota Territory Chapter seminar, installer certification, Watertown, S.D. Contact: Kent Binkerd, (605) 339-3339.

18: SCTE Dixie Chapter seminar, Montgomery, Ala. Contact Scott Peden, (904) 968-6959.

18: SCTE Golden Gate Chapter seminar, back to basics, Viacom Headquarters, Pleasanton, Calif. Contact Mark Harrigan, (415) 358-6950.

18: SCTE Great Lakes Chapter seminar, safety and construction practices, Holiday Inn, Livonia, Mich. Contact Jim Kuhns, (313) 541-4513.

18: SCTE Michiana Chapter seminar. Contact Russ Stickney, (219) 259-8015.

18: SCTE Mount Rainier Chapter seminar, Martha Lake, Lynnwood, Wash. Contact Gene Fry, (206) 747-4600, ext. 107.

18: SCTE Smokey Mountain Chapter seminar, occupational safety, Days Inn, Kingsport, Tenn. Contact Roy Tester, (615) 878-5502.

18: SCTE West Virginia Mountaineer Chapter seminar, OSHA safety, Holiday Inn, Fairmont, W.Va. Contact Joseph Jarrell, (304) 522-8226.

18: Tektronix seminar, how to evaluate your system, Ramada Renaissance, New York. Contact Kathy Richards, (503) 627-1555.

18-20: Scientific-Atlanta seminar, headend and earth station, Portland, Ore. Contact Bridget Lanham, (404) 903-5516.

19: SCTE Central Illinois Chapter seminar, new technologies, Holiday Inn, Brandywine, Ill. Contact Chuck Prosser, (309) 347-7071.

19: SCTE Dakota Territory Chapter seminar, installer certification, Fargo, N.D. Contact Kent Binkerd, (605) 339-3339.

19: SCTE New England Chapter seminar. Contact James Kelley, (401) 943-7930, ext. 230.

20: Tektronix seminar, Marriott Hotel, Worcester, Mass. Contact Kathy Richards, (503) 627-1555.

Planning ahead

Dec. 2-4: Western Cable Show, Convention Center, Anaheim, Calif. Contact (415) 428-2225.

Jan. 6-7: SCTE Emerging Technologies conference. Contact (215) 363-6888.

Feb. 24-26: Texas Cable Show, San Antonio, Texas. Contact (512) 474-2082.

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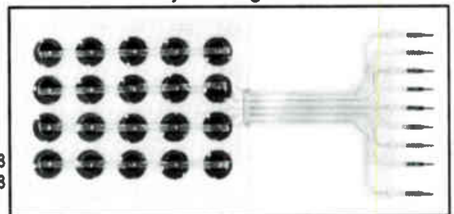

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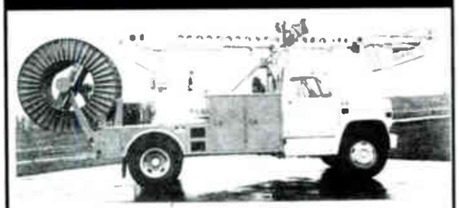

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SCTE board convenes at site of Cable-Tec Expo '93

By Bill Riker
President
Society of Cable Television Engineers

The board of directors of the Society of Cable Television Engineers held its fall meeting Oct. 1-2 in Orlando, Fla., which is the site of the upcoming Cable-Tec Expo '93. In addition to a meeting of the full board, individual meetings also were conducted by the Society's Training, Engineering, Operations and Planning Committees, plus the Expo '93 Program Subcommittee.

Following this series of meetings, the board, committee members and chapter representatives took a tour of the Orange County Convention Center and later inspected several potential sites for the convention's main social event, the Expo Evening.

Bill Riker

The SCTE board of directors addressed topics of vital importance to the Society's future during its Oct. 2 meeting held in Orlando, Fla.

Bill Riker

The board took a tour of the newly expanded Orange County Convention Center, site of the upcoming Cable-Tec Expo '93.

During its meeting on Oct. 1, the Training Committee addressed such issues as installer recertification, the updating of BCT/E examinations and related study materials and new procedures for exam proctors. The Engineering Committee heard updates on the activities of its CLI, EBS, Design and Construction, Maintenance Practices and Procedures, Interface Practices and In-Home Cabling Subcommittees.

The Operations Committee discussed the creation of a new industry technical award, plans for another golf tournament to be held at Expo '93 and the status of other SCTE awards programs. The Planning Committee discussed the nominations process for the 1993 board of directors election in addition to methods for achieving the top six goals identified by the committee during its last meeting. (See "President's Message" in the October 1992 issue of *Communications Technology*.)

Results of board's voting

When the full board convened the following day, it heard reports from each of the standing committees in addition to recommendations developed by the Executive Committee during its meeting last month. The board then voted to:

- Conduct a full financial audit of the Society, including its 74 local chapters and meeting groups.
- Approve the creation of a new technology award to be presented at the Society's annual Conference on Emerging Technologies.
- Produce the Society's *1993 Membership Directory and Yearbook* completely in-house as preparation for SCTE's eventual undertaking of the publishing of its own technical journal.
- Hold its 1994 Emerging Technologies conference in Phoenix, Ariz. (The 1993 Conference on Emerging Technologies will be held Jan. 6-7 in New Orleans.)
- Hold the 1995 Cable-Tec Expo in Las Vegas, Nev. (Expo '93 will be held April 21-24 in Orlando and Expo '94 is scheduled for St. Louis.)

"The Operations Committee discussed the creation of a new industry technical award, plans for another golf tournament to be held at Expo '93 and the status of other SCTE awards programs."

Other recommendations made by the various committees will be incorporated into the Society's 1993 budget, which will then be reviewed by the Finance Committee before presentation to the full board at its next meeting, scheduled for Dec. 1, prior to the Western Cable Show in Anaheim, Calif. **CT**

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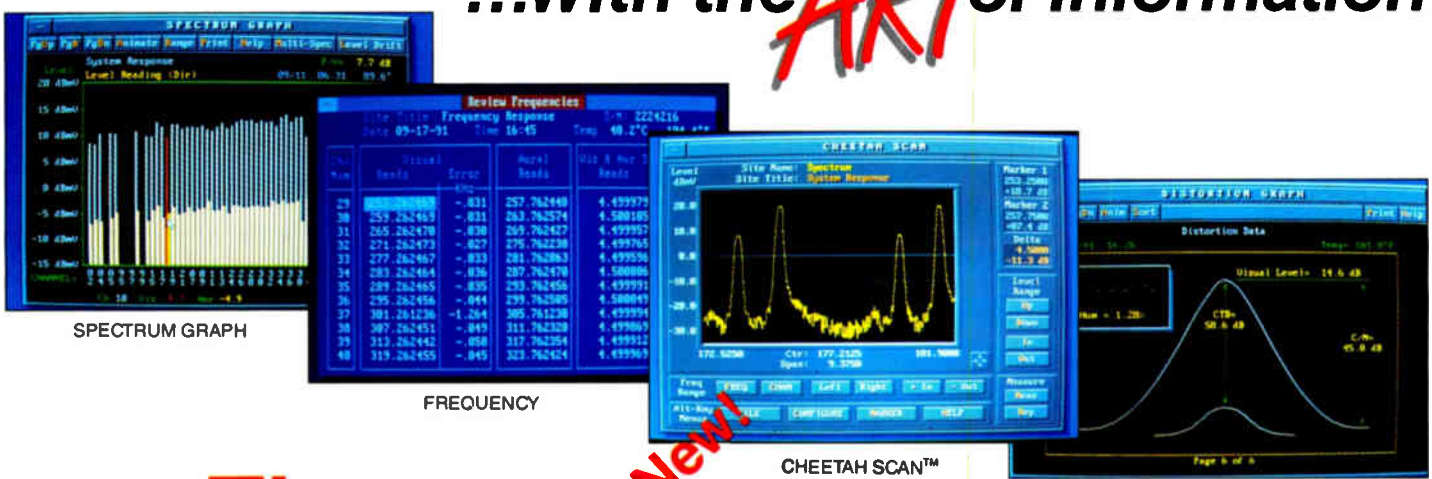

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