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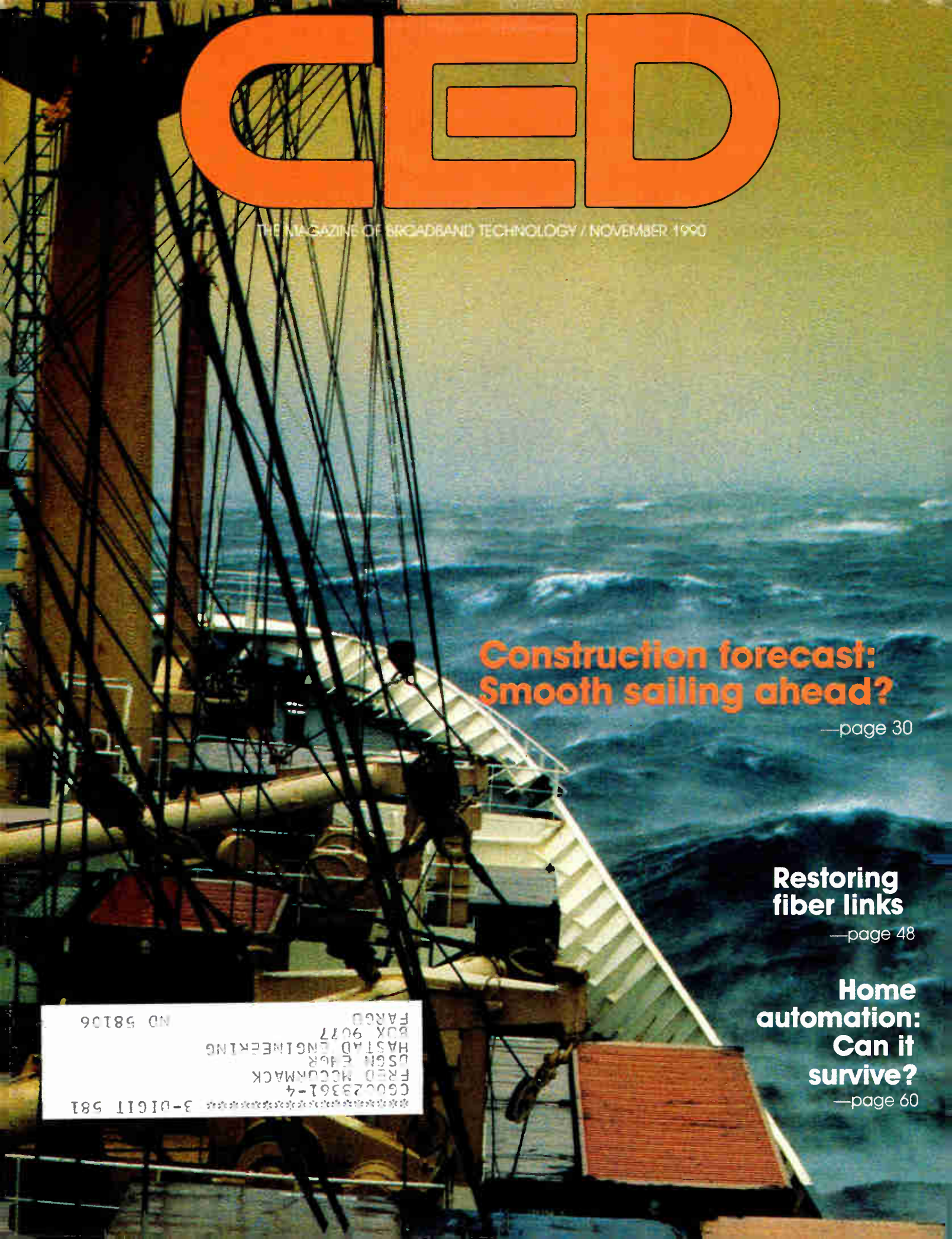

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—page 60

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November 1990

CED

Volume 16, Number 12

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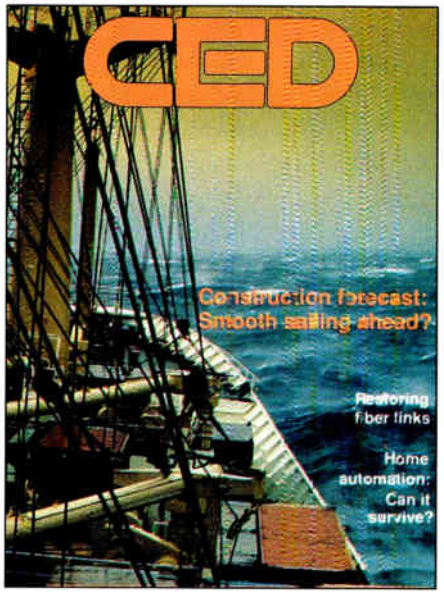

About the Cover:
Hardware vendors are battered by strong winds. Will 1991 be better? Photo by Stock Imagery.

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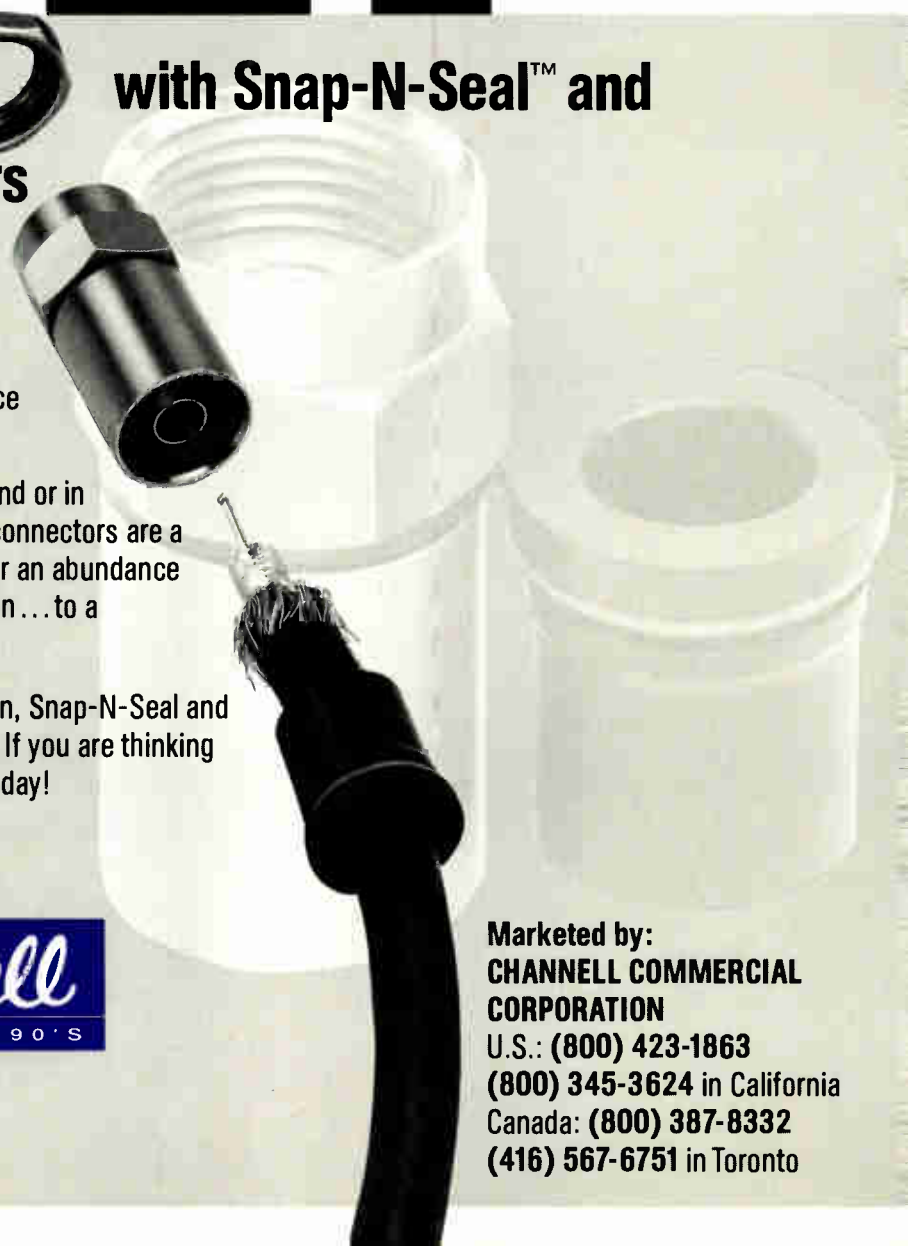

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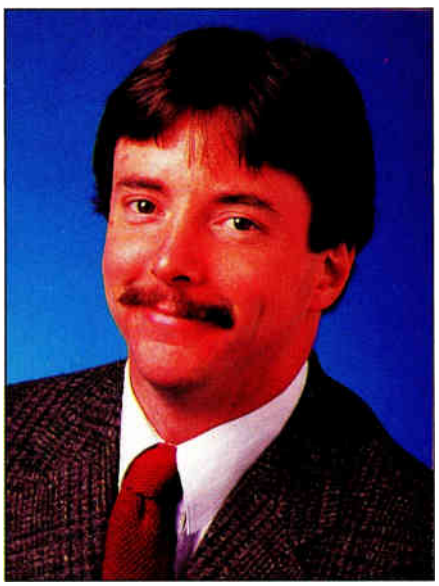
When your reputation is at stake

By now, most industry experts believed the Federal Communications Commission would have snared its first big signal leakage violator, made an example of the system and fined the operator accordingly. A few weeks ago, a public notice was issued and reporters and operators alike thought this was the one.

But instead, what the FCC has is a big mess. For those who haven't heard, here's a brief recap: The Multivision system in Hermosa Beach, California, which just happens to be located near the clogged LA International airport, was found to be non-compliant by a visiting inspector and a cease and desist order was issued and transmitted by telegram. It isn't clear exactly how many channels were affected, but it seems the entire aeronautical band was ordered to be shut down until the system was found to be in compliance once again.



Multivision system officials acknowledge receipt of the order, but there is some confusion over what happened next. No one who watches the system ever noticed that it shut any channels down. In fact, statements from system officials in published reports seem to say that technical crews were mobilized to repair the leaks. It appears that outside of that activity, little was out of the ordinary in Hermosa Beach that day.

Currently, the FCC is busy reviewing the case. Did the cable system willfully violate federal law and continue operating despite its potential to interfere with aircraft? Does a system found to be in violation have to wait for the FCC to reinspect before it can resume transmitting? Apparently, no one's quite sure.

Add to the confusion a lack of resources for ongoing inspections and suddenly you have an important federal guideline that is practically unenforceable. Everyone has done the math in their heads: How could the Commission possibly detect and inspect more than a few leaking systems every year without a significant increase in funds? I'm sure there are a number of systems that outright falsified signal leakage documents, hoping to never be caught.

But with its reputation at stake, the FCC isn't about to lay down its arms. In fact, John Wong, assistant chief of the cable TV branch, continues to lobby for more resources and persists in his quest to make an example out of an obvious and willful violator.

Cable engineers who have poured a lot of money and time into meeting compliance criteria are also concerned. They understand the benefits of a regular monitoring program, but they fear their financial managers may not. Privately, they're worried that a lack of FCC clout could force them into a corner as money managers order a reduction in technical personnel, choosing to "chance it" when it comes to leakage.

Everyone should remember one thing, however: Do you want your name in the trades as the first one who got caught with his back turned?

Roger J. Brown

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Reader Service Number 5

High marks go to cable ops for CLI filing efforts

Cable-television operators were given generally high marks for their efforts to meet the July 1 signal leakage compliance deadline by John Wong, assistant chief of the cable television branch of the Federal Communications Commission during an SCTE-sponsored technical seminar at the Altantic Cable Show in Atlantic City.

As of that time, 91 percent of the industry was found to be in compliance with the rule governing completion of Form 320, the document that must be completed and returned to the FCC with annual CLI or flyover test results. Wong said 28,800 forms were mailed earlier this year and about 26,000 were returned.

Many of the 2,800 outstanding forms went to cable systems that do not utilize aeronautical frequencies and therefore are not required to file. (Conventional wisdom says there are about 8,000 cable "systems" in the U.S., but the FCC focuses on "community codes." One cable "system" may actually cover several "communities" hence, the difference in numbers.)

Some 1,500 forms will be "followed-up on" by the Commission, mostly because the filings are confusing, not because the FCC is suspicious, said Wong. Each and every document filed has been personally reviewed by either Wong or staff engineer Michael Lance for error.

Approximately 500 forms were actually filed late, while others arrived without proper signatures, without information on the frequencies used by the system or with computation errors. In the latter case, Commission personnel have corrected the mathematics. The vast majority of filings came in with CLI numbers between 45 and 53, Wong reported.

The session was also the first opportunity for cable operators to query Ron Parver, chief of the cable TV branch who focused his presentation on enforcement. Parver said systems having problems complying often blame their technical personnel who, in turn, say they don't have the proper resources to comply with what is actually a management issue.

However, Parver said the FCC cannot get involved in the squabble—it simply requires compliance. "You cannot put the Commission in the situation where it condones interference," he said. "You can't ask the Commission to stick its neck out."

Wong concluded his presentation by noting how the cable industry has to go before it's off the hook. The FCC hopes to be able to discard the frequency offset rules by 1995, when the FAA is scheduled to split its frequencies. "The (cable) industry has not shown the Commission" it can remain in compliance simply by monitoring its systems and filing annually, he said.

FCC bans CATV/MMDS cross-ownership

Making good on its promise to relax constraints on alternative forms of video delivery, the FCC has adopted comprehensive new rules that govern the microwave frequencies allocated for wireless cable and decided to prohibit cable systems from owning such systems in their franchise areas.

The decision was applauded by wireless industry players, who have long maintained that cable television operators have unfairly impeded their growth by restricting their access to programming or by "warehousing" frequencies needed to provide more channels.

> As of September, 91 percent of the industry was found to be in compliance with the rule governing completion of Form 320.

In addition to a host of other rules, most of which govern the licensing procedure, the Commission decided to allow MMDS operators to utilize the cable television relay service (CARS) band of frequencies located around 13 GHz. The National Cable Television Association opposed providing access to these frequencies because cable systems use them to serve educational institutions and sparsely populated areas.

In addition, cable systems were prohibited from owning or operating MMDS facilities within their franchise area unless the area would otherwise be unserved. The standard for what constitutes an "unserved area" will be addressed in a Further Notice of Proposed Rulemaking, which will also cover the issue of grandfathering additional cable/MMDS operations.

In addition, the FCC gave wireless operators the go-ahead to utilize 100-watt transmitters and signal boosters to provide improved signal quality into "shadow" zones like mountain valleys.

CableLabs seeks EPG input

In the interest of easing the cable/consumer electronics interface and provide more user-friendly service, Cable Television Laboratories (CableLabs) has issued a request for information regarding a project that seeks to establish a cable industry electronic program guide.

The project will try to define for the cable industry a guide that may be: interactive with the viewer; allow programming to be sorted by a variety of factors, including type of program, "mood" of program, time of day, programming service or name of key stars; automatically program VCRs and cable converters to tune to such programs and record them.

The idea has grown out of the backyard satellite market, where circuitry included in the descrambling receiver provides information about the program, the time of day it begins and ends, where the programming is located, etc.

According to CableLabs, the RFI was mailed to 26 companies that have shown an interest in or have underway efforts related to an automated, interactive guide. Two major goals of the RFI is to define a guide that does not occupy a full 6-MHz channel slot and which can reside in the consumer electronics hardware purchased by the viewer.

The project is being coordinated with the EIA/NCTA Joint Engineering Committee, which is working to develop

When is a modulator not a modulator?

both in-band and out-of-band transmission standards for the program guide data. Consumer electronics manufacturers are also lending their expertise in order to ensure that the product is compatible with future production plans for TVs, VCRs and other devices.

As CableLabs officials note, cable systems typically consist of at least 35 channels, thereby offering more than 1,000 program choices every day. This forces viewers to spend more time with program guides published in newspapers or select programming choices in a hit-and-miss fashion via remote control. While some electronic guides are helpful, they are carried in a full 6-MHz NTSC channel slot, chewing up a valuable resource.

Signal quality tests ready for public

Another CableLabs project is now up and running. The subjective testing of NTSC video signals, which will take place in Jerrold Communications' Applied Media Lab, is nearly ready to be shown to the general public for its input.

As press time approached, the demonstration was being shown to numerous "expert" viewers, including engineering executives from major MSOs and programming services.

The goal of the demonstration, according to CableLabs and Jerrold officials, is to provide test results that will allow cable operators who plan to upgrade their systems to pinpoint specific performance parameters to deliver optimal video to subscribers. Extensive scientific testing of NTSC video hasn't been performed since the well-known TASO tests of the 1950s.

This round of testing will focus specifically upon five basic forms of degradation, including noise, intermodulation, micro-reflections envelop delay and phase noise as well as combinations of the five. The testing will be software controlled and will open to the public sometime in January, according to Jerrold officials.

The exercise has pointed out the critical differences between television receivers and the importance of properly calibrating the pictures of two or more receivers. CableLabs has determined that to properly test picture quality, it needs receivers that can deliver at least 58 dB composite signal-to-noise. However, televisions today are limited to 53 dB or 54 dB.

Labs, Canadian firms team to test ATV

And finally, CableLabs has agreed to help three Canadian organizations test satellite-based advanced television systems.

The Boulder, Colo. cable research arm will join with the Canadian Broadcasting Corp. (Canada's national broadcaster), the Communications Research Centre of the Canadian Department of Telecommunications (a government R&D facility) and Telesat Canada (a satellite communications company) to perform both subjective and objective tests of NHK's MUSE-E and Scientific-Atlanta's HD-BMAC transmission systems.

The planned tests closely resemble those planned by the FCC Advisory Committee on Advanced Television Service, the body given the charge for selecting a national standard for terrestrial distribution of high definition television. The test results will be used to determine optimum parameters for satellite transmission of ATV and provide a benchmark to assist in identifying applications appropriate for each system.

Specifically, the tests will examine the quality achieved by each system under optimal reception conditions; the system's ability to maintain that quality when combined with imperfections in the satellite channel or signal interference; its ability to be converted into high quality NTSC signals; and the ability to avoid interfering with NTSC satellite transmissions.

The objective tests and satellite simulations are being performed at the Telesat Laboratory in Ottawa. The subjective tests will be done at a new ATV testing facility operated by the Communications Research Centre in Ottawa. The first phase of testing will be completed this year.

Jerrold garners huge UK order

Cross Country Cable has ordered more than $50 million in cable-television equipment for its United Kingdom franchises, which when built will pass more than 400,000 homes.

The Warren, N.J. cable operator has teamed with minority partner Nynex to develop hybrid cable/telecom networks in Brighton and Bournemouth as well as the London borough of Bromley.

Three separate addressable headends will generate the programming, while Jerrold's new 550 MHz SX amplifier will be combined with its AM fiber optic equipment to provide a two-way interactive network offering impulse pay-per-view and other services not commonly offered to European viewers. The system will take five to six years to build, according to Cross Country Cable officials.

The system will initially be designed out to 750 MHz, with later upgrades to 860 MHz and 1 GHz planned. As each phase is completed, fiber optics will move closer and closer to the home. Those phases will be driven by market demand for new services and channel capacity, said Mark Dzuban, VP of engineering and the project's manager.

Texscan refinances long-term debt

Texscan Corporation's efforts to emerge from past financial woes received another shot in the arm last month when the company refinanced its long-term debt.

The refinancing arrangement provides for $16.9 million in unsecured nine-year notes at a 11.27 percent fixed interest rate, with principal repayments beginning in October 1993. The agreement replaces $13 million in varying rate senior debt and $3.6 million of subordinated debt at a 15 percent interest rate. The subordinated debt interest payments were paid in company stock as "payment in kind." The new financing pact eliminates this dilutive impact, said a Texscan spokesman.

According to Harold Tamburro, VP and CFO of Texscan, the refinancing allows the El Paso, Texas-based electronics supplier to invest cash generated from operations into areas with significant growth potential by eliminating many previous restrictions on the company's cash balances.

As of July 31, Texscan had a cash balance in excess of $9 million. Institutional investors, led by insurance companies affiliated with CIGNA Corp., provided funding for the refinancing.

—Compiled by Roger Brown

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"Successful people form the habits of doing things that failures don't like to do."—Albert E.N. Gray

Perhaps that credo is what earned Larry Nelson his moniker of executive VP/chief operating officer of Comm/Scope Inc. "I like to think of myself as being action oriented," Nelson says. "Typically, I try to accomplish things other people find difficult to do—I enjoy the challenge," Nelson says. A quiet man, Nelson retains an unwavering calmness that complements his unassuming drive for quality and success.

Nelson is no stranger to Hickory, North Carolina—Comm/Scope's home turf. Aside from a brief stint in Connecticut, the Tar Heel State has always been home for Nelson. He earned a degree in engineering and mathematics from North Carolina State, and his MBA from North Carolina University. In between, while working on aerospace research and design for United Technologies in Connecticut, Nelson picked up his Masters of Engineering from Rensalier Polytechnic Institute.

22-year cable veteran

Nelson has been active in cable television since 1968, when he joined Comm/Scope as an engineer for the company's then fledgling coaxial division—and has remained ever since. "The early years were especially interesting," Nelson recalls. "They were a time of real dynamic change. We were developing new products for a what was a new market."

Those changes included Nelson's efforts to spearhead a patent for a new production process that decreased coaxial cable attenuation, which Comm/Scope received in 1978.

Nelson's plate was the fullest in the late 1970s—with managing the patent process, industry growth and introducing new products. "This period of time had to be the most challenging for me," Nelson muses. "We had minimal resources and had to manage both the product changes and ensure that the product had the quality and requirements that our industry needed—and at the same time, manage the growth rate. It's quite a technical challenge to develop new products, introduce a new process and expand in capacity, all at the same time."

Quality is an issue that Comm/Scope's new chief operating officer doesn't take lightly. In fact, instilling a quality attitude in every employee is Nelson's number one goal. "The thing I stress the most is that quality is the number one objective in whatever we do. That's not only for the finished products that we ship—that's for everybody," Nelson says. "Everybody's job requires quality, whether it's janitorial, or the president's job, or the secretary's job. We have to simply do the best possible job we can do in order to be a quality company. So I spend a lot of time trying to create a quality atmosphere. You have to motivate people to do a quality job."

Nelson achieves this with extensive in-house training programs and utilizing the one-on-one management approach with each of the 1,300 employees. This gives Nelson a chance to discuss company objectives and determine "how they feel about what they're doing."

Cars and cable TV

On the home front, Nelson and his wife of 24 years, Brenda, have two sons, David, 20, and Morgan, 10. David, Nelson's older son, is in college studying video production and communications; Morgan shares the name of Larry's weekend passion: vintage car racing. Nelson owns five British Morgan sportscars, one of which he races as often as possible. "Work is probably my number one hobby, but car restoration and racing is a pretty close second," Nelson chuckles. "I race them myself. I like to buy old cars, restore them, and race them."

Regarding the future of cable television, Nelson is guardedly optimistic. "Video is a proven commodity, and it's growing. Subscribers are demanding more outlets, buying more TV sets, and there's more programming. We'll have a rough time for a year or two, but we'll come out of it." Nelson thinks the future market conditions loosely parallel the period of change cable television experienced in the late 1970s. "But it's different this time around. One of the more challenging things to deal with is how coaxial and fiber optic systems are going to complement each other to best serve our customers."

Does Nelson consider fiber a threat? "Fiber is a very useful technology, as is coax. They'll both be used to the best advantage of cable operators. In the near term, I don't think fiber optic equipment will replace coaxial systems in total. I think fiber is important to the industry, and there will be growing applications, but they will be complementary to us. So the challenge for Comm/Scope as a cable manufacturer is the successful coexistence of both products."

Nelson's biggest project is concentrating on the impact of fiber usage on coax. "Trying to keep up with that and react to it is a big job," Nelson says. "Technologies will develop and be implemented and demanded by the users, just as fiber was. All we can do is recognize it, try to understand it and decide what we as a company should do in light of that technology. There are many questions to be answered over the next few years."

Nelson is an active member of the National Cable Television Association's Engineering Committee, and chairs its In-home Wiring subcommittee. Currently the subcommittee, which meets bi-monthly, is developing wiring guidelines, specifications, and educational materials for cable operators who need to react to developments in pre-wiring and intelligent home systems.

It's rare these days to find someone who's stuck with a single employer for more than two decades, but Nelson wouldn't have it any other way. When asked why he chose to remain with Comm/Scope for so long, Nelson responds: "Good people. Good industry. Good company. And enough challenge to keep me busy. I've just never had a good reason to do anything different." ■

—Leslie Miller

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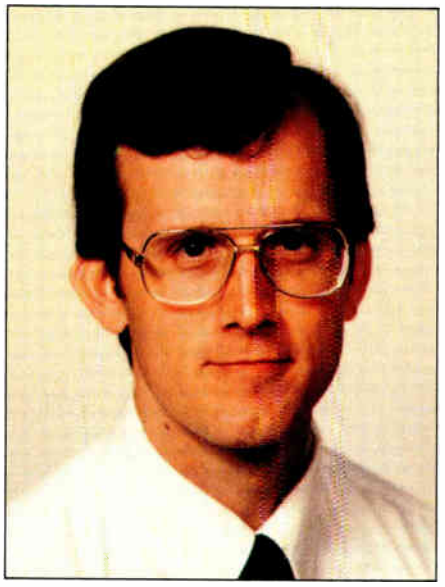


Measurement errors revisited

Back in May of this year, I wrote a column entitled "Measurement errors"[1], in which I described some of the pitfalls in using a test demodulator that is operating in the envelope detection mode when measuring the video performance of a modulator. Specific video parameters were measured in both synchronous and envelope modes of operation, and their differences noted. I then referred to some rather baffling data for chrominance-to-luminance (C/L or C/Y) gain inequality as measured by the Tektronix VM-700.

Not long after the article was published, I received an excellent letter from Howard Landsman and Margaret Craig of Tektronix clarifying the results of that measurement, and further detailing the hazards of video measurement when using a demodulator that is operating in the envelope mode. Because the letter is an excellent tutorial, I have decided (with their approval) to publish the bulk of it.

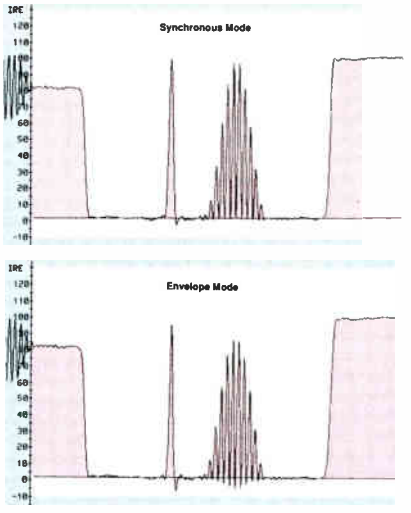
"...We are writing to offer insight into the issues discussed—perhaps we can explain the measurement results you obtained in your characterization of modulator performance.

C/Y measurement methods

"First of all, we would like to point out that the VM700 chrominance-to-luminance gain inequality results you reported are consistent with the published waveform pictures.

"As you are no doubt aware, a modulated 12.5T pulse is not simply a chrominance packet. It is made up of a sine-squared luminance pulse added to a chrominance packet with a sine-squared envelope. Since both of these components affect the 12.5T pulse amplitude, one cannot simply assume that a low-amplitude pulse is the result of a roll-off at subcarrier frequency.

"Comparison of the amplitude of the 12.5T pulse to the bar can be a fairly good approximation of C/Y gain inequality *if* one is dealing with linear systems with little or no C/Y delay. A far more reliable practice, and the method for which the 12.5T pulse was actually designed, involves comparing the chrominance amplitude of the 12.5T pulse to the luminance amplitude of the same pulse. This has traditionally been accomplished by normalizing the amplitude of the pulse to 100 IRE, measuring the baseline deviation, and applying these numbers to a nomograph.



"In your Figure 1b, the fact that the chrominance bows out below the baseline at the bottom of the pulse indicates that the chrominance amplitude is indeed higher than the amplitude of the luminance portion of the pulse. The reading of 114 percent is therefore plausible. The fact that the overall pulse amplitude is low tells us only that either the luminance component, the chrominance component, or both have not been accurately transferred through the system. The low overall pulse amplitude definitely indicates a problem, but not one that can be characterized by a C/Y gain measurement.

Mod/demod measurement practices

"The second issue we would like to clarify is the reason that chrominance-to-luminance measurements should not be made with the demodulator in the envelope detection mode. Such measurements should be avoided *not* because the measurement device makes errors in this mode, but because the signal actually becomes distorted.

"Quadrature distortion, which is inherent in envelope detection of vestigial sideband signals, is the primary reason for avoiding the envelope detection mode for measurements. Quadrature distortion manifests itself as various non-linear distortions, often so severe that they tend to mask any distortions present in the modulator itself. Synchronous detection is therefore provided in test demodulators so that the effects of quadrature distortion can be removed.

"Your waveform pictures indicate that the signal is indeed suffering from significant distortion. While it is not immediately obvious why the amplitude of the luminance portion of the 12.5T pulse has been reduced, it is most likely because of non-linearities in the system. These may be in the modulator, or may be effects of quadrature distortion.

"In order to best separate the effects of the various distortions, it is generally recommended that one first verify that ICPM and static phase error in the demodulator are negligible, and then use synchronous detection for most measurements. C/Y gain and delay are particularly sensitive, and must always be measured in the synchronous mode if one is trying to accurately characterize the modulator under test.

"In summary, the VM700 does appear to be making the C/Y gain measurement correctly, but the results are not relevant when measured in the presence of non-linearities and quadrature distortion."

My thanks to Mr. Landsman and Ms. Craig for their excellent tutorial. ■

References

1. Bowick, Chris, "Measurement errors," *CED*, May 1990, p.26.
2. Bowick, Chris, "Envelope vs. synchronous detection," *CED*, November 1989, p.20.

By Chris Bowick, Vice President Engineering for Headend Equipment, Scientific-Atlanta Inc.

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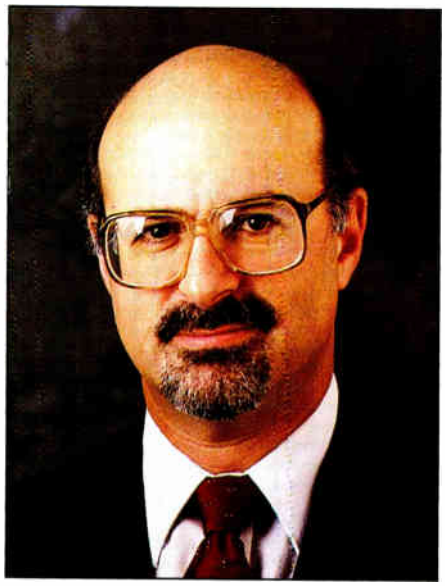

Do we need a scrambling standard?

From time to time, someone in the cable industry says, "Those darn converters—we need a single national standard for scrambling, and then we could get rid of set-top converters." There is interest now in Washington in a scrambling standard, but it is not being led by the cable industry.

The interest in Washington is coming from the Congress and the Advanced Television Systems Committee (ATSC), not the cable industry. Congress is looking at a scrambling standard as a step toward forcing cable operators to sell converters to their subscribers, so that subscribers could avoid a monthly rental charge. This is something like allowing customer ownership of telephones.

In order to achieve customer ownership of converters, the House of Representatives has put language into the Cable Television Consumer Protection and Competition Act of 1990, requiring the FCC to study cable scrambling technology, to see whether a standard should be required. Another part of the study would look at the feasibility of including the converter/descrambler circuitry in the TV set. Although this provision passed the House in early September, it is not clear (as I write this in late September) whether the cable bill will make it through the Senate this year; if not, it will probably come up again next year.

In addition, the Washington-based ATSC has a "specialist group" looking at the feasibility of a single scrambling standard for cable and satellite transmission of high definition television. The ATSC is an industry group that has some members from the cable and satellite industries, but it is dominated by the broadcasters. Earlier this year, this group decided that as a design goal, an HDTV scrambling standard has to be secure enough so that all of its details can be made public.

By Jeffrey Krauss, Independent Telecommunications Policy Consultant and President of Telecommunications and Technology Policy of Rockville, Md.

Toward a scrambling standard

Some think that the MultiPort standard, now known officially as EIA standard 563, could be a step toward a cable scrambling standard. The MultiPort device, which plugs into the special connector on the back of some TV sets, is a descrambler. It uses the "cable-ready" tuner in the TV set rather than the tuner in a cable converter.

In the future, perhaps, the MultiPort device could be made as a tiny plug-in cartridge that does not need an external power source, and would not be seen from the front of the TV set.

Once we get to the stage in the technology where every cable subscriber has a "MultiPort-ready" TV set and the MultiPort devices are tiny, then we could think about a scrambling standard. All of the plug-in cartridges could be the same. And the next step after that would be to build the circuitry into the TV sets, rather than using the external connector.

However, if the goal of the MultiPort standard is to get rid of the set-top converter and allow subscribers to use their TV remote controls, then maybe the step to a scrambling standard isn't needed. Just getting the MultiPort device down to the size of a cartridge, and getting the TV set manufacturers to build the MultiPort connector into all TV sets (and VCRs) should be sufficient.

Stimulating piracy

The other side of the coin is piracy. Theft of service is a serious problem for cable systems, but the absence of a scrambling standard has retarded piracy. A typical cable subscriber cannot simply call a telephone number in Canada, Mexico or some Caribbean island and order a pirate descrambler. There are too many different scrambling systems in use in the cable industry.

This is far different than the home dish industry. There, the VideoCipher® II is the standard. Pirates have devoted enormous resources to cracking the VC II, and one of the reasons they succeeded is that it provided a single point of attack. While it allowed home dish owners to use the same decoder to receive HBO, Showtime and all the other C-band programming, it also allowed pirates to focus all their efforts on a single system.

The ATSC notion that a scrambling standard should be public seems to me to be a "head in the sand" approach. Why give the pirates the details of the scrambling system, including the layout of the authorization messages and the details of the scrambling algorithm? I agree that next-generation digital encryption of video will be more secure than today's analog scrambling, and the pirates probably would not be able to decode a digitally-encrypted picture easily. But the weak point is likely to be the key distribution procedure and the management of the authorization messages, not the encryption algorithm. With the VC II, the pirates didn't defeat the Data Encryption Standard encryption algorithm, they made the descrambler think it had received a message that authorized the descrambling. Adopting a scrambling standard and then making the details public is likely to make these kinds of attacks easier and more successful.

Prove security, then standardize

At least for the forseeable future, a single scrambling standard for the cable industry is unacceptably risky. Let the home dish industry or the DBS industry take the lead in testing different scrambling and encryption systems. Let them weed out the breakable systems. If and when an unbreakable system emerges, the cable industry might want to develop a plan that would lead to an industry standard, and work out licensing arrangements so that the technology could be built into TV sets.

Until then, the MultiPort standard looks like the best hope for getting rid of those darn converters. But we may have a long wait until the MultiPort connectors are included with all TVs and VCRs. ■

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Reader Service Number 11

Franchises

The late Ed Parsons was an electronics hobbyist in Astoria, Oregon, who also owned and operated radio station KAST. On November 25, 1948, the first television station in the Pacific Northwest began operation on the King Tower in Seattle. Ed Parsons devised a mobile antenna rig with which to probe the area near his home for a "Hot spot" where KRSC-TV (now KING-TV) could be received, nearly 125 miles away. Soon, his neighbor was asking if Ed could help him get television. That was easy. He simply ran some RG-11/U cable from his roof-top to his neighbor's. Then neighbors down the block and across the street wanted television, and Ed was ready to oblige.

By now, Ed Parsons had become a local celebrity. Nevertheless, the Astoria Fire Department took a dim view of stringing wires across the streets, from roof-top to roof-top. They began to worry about clearances, grounding, and other pesky hazards.

Community television

Pole attachment agreements with the telephone and electric utilities took care of the Fire Department concerns. But now, Ed had to find some way to pay for pole leasing. His little neighborhood system had become a community Television network.

In 1948, John Walsonavich was proprietor of an electrical appliance dealership in Mahanoy City, Pennsylvania, known as Service Electric Company. Trying to sell television receiver in the valleys beyond the "fringe areas" of Philadelphia television stations was a conspicuously unrewarding enterprise. John had to head for the hills to find TV signals strong enough to be interesting.

He nailed thousands of feet of twinlead to trees, fence posts, billboards and probably even utility poles to get the signal down to town. Rain on the twinlead caused enormous signal losses, completely wiping out any semblance of useful television, and he had to change over to coaxial cable.

Both of these historic events demonstrate that municipalities do, in fact, need to exercise control over the placement of overhead wires in the public rights of way. This is their inherent "police power." To allow wires to be strung or trenches to be dug willy-nilly over and under the streets and sidewalks of the city would soon lead to chaos and intolerable hazards. The authority by which municipalities award cable TV franchises is derived directly from, and based on their intrinsic police powers.

Within a few years after KRSC-TV began transmitting television signals in Seattle, community TV systems popped up throughout western Washington state. Jack Zeckman was a TV repairman and mobile radio technician who built community TV systems in Centralia and Chehalis, Washington. He obtained franchises from the cities, agreeing to pay them a nominal one or two percent of his gross revenues.

Then in 1953, KXLY-TV began operation on top of 6,000-foot Mount Spokane, the first TV station in eastern Washington. There were scattered reports of TV reception in hot spots as far east as Missoula, Montana, 170 crow-flight miles from Mount Spokane.

The next year, Jack Zeckman drove up to the Missoula City Hall to inquire about obtaining a franchise for a community TV system in that beautiful university town, located in the "five great valleys." He was directed to John Vance, a practicing attourney who had recently been elected to the city commission.

Missoula franchise

After listening to Zeckman's story, Commissioner Vance told him that community TV sounded like a great idea for Missoula. Certainly, the city would be quite happy to accept two percent of the gross revenues in return for a franchise. Like any other city, Missoula needed the money.

As an attorney, however, Vance believed the city was fully protected by the franchise under which Mountain States Telephone Company and Montana Power Company were allowed to place poles and wires in Missoula's public ways. He was sure that any lease agreement with the utilities would include the power to prevent violation of any Missoula codes or ordinances. "If we don't like what you are doing," he told Jack, "we will simply instruct the utilities to take any steps necessary to correct the situation."

So far as I can determine, cable TV franchises are rare in the state of Montana. Few, if any, other states have taken a similar position. However, I do have a letter from an operator in Guam stating that a franchise is not required on that island.

A question of authority

Could it be that we put our own necks in the franchise noose unnecessarily? Do police powers really grant the municipalities the authority to extract promises of free services and equipment worth millions of dollars?

'Could it be that we put our own necks in the franchise noose unnecessarily? Do police powers really grant the municipalities the authority to extract promises of free services and equipment worth millions of dollars?'

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

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Reader Service Number 12

Was it really necessary to provide unmarketable and unproductive facilities designed more to stroke egos than to turn a profit? Did the cities ever, in fact, really have either the authority or the professional skills to regulate rate structures?

In the early 1960s, the cable TV industry searched vigorously for "essentiality" that might not only gain 99 percent penetration, buy could also greatly improve its position in the political arena. We looked at all kinds of non-entertainment services. Nothing the telephone companies now promise escaped our notice. It was our own somewhat overblown enthusiasm for two-way communications that prompted Federal Communications Commission chairman Dean Burch to declare in 1972 that if cable TV were "just another way of moving broadcast signals around," it would "hardly be worth the ulcers involved."

Broadcast localism

The 1972 FCC regulatory framework for cable TV was an open invitation to subsequent municipal demands for handouts and gratuities, even though much of that was later rejected in the courts. But the FCC emphasis on non-broadcast localism, as manifest in the PEG (Public, Education and Government) access channels effectively assured a major position for municipalities in regulating cable TV.

> 'If cable TV were just another way of moving broadcast signals around, it would hardly be worth the ulcers involved.'

It was probably already too late by 1970 when there were only 4 million subscribers. But had senate bill S-2653 passed and become law in 196', cable TV operators would now be licensed and under FCC regulation. Instead of hearings before city boards or committees having little or no technical nor even economic expertise, comparative licensing and renewal hearings could be held before better qualified FCC personnel. Instead of vaguely conceived and poorly stated criteria, differing sharply from city to city, FCC hearing criteria would have been reasonably uniform and well known in advance. It would have been more difficult to bluff the FCC, and insincere promises without technical and economic justification would most likely have been discounted.

Has cable been lucky?

Maybe we have been favored the past 30 years to have been able to operate without the FCC licensing, subject only to the vagaries of several thousand municipal regulatory authorities. But I still wonder why the "police powers" of cities grant them the right to regulate rates, dictate program schedules or enforce unachievable promises having nothing to do with the public safety. ■

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Reader Service Number 50

Another side to the story

I am prompted to write you about the article regarding CableTrac which appeared on page 10 of the September issue of *CED* under "Color Bursts." There is a great deal of misinformation in the article as there has been in most other references to the subject. Therefore, I would like to set the record straight.

CableTrac was a joint venture that was formed in October 1988 between Fred Kaiser's company, Alpha Technologies, and my company, Dovetail Systems. Alpha contributed seed capital in the amount of $125,000, and Dovetail contributed an ongoing aerial cable signal leakage measurement business.

Despite the success of CableTrac Inc., Mr. Kaiser and I had various disagreements and misunderstandings regarding the conduct of the joint venture. As a result, I offered to buy out Alpha's interest, and Mr. Kaiser countered, in November 1989, with a lawsuit against Dovetail, my wife and myself in which he initially sought to recover in excess of $6.5 million.

Following the outright dismissal of the claims against my wife, a trial was conducted before Judge William L. Dwyer in Seattle at the end of June 1990. Both sides agreed that CableTrac should be dissolved, and Judge Dwyer then ordered that such a dissolution occur and that Alpha be repaid the amount of its investment, together with interest, which brings Alpha's total recovery to slightly less than $152,000.

Apparently disappointed by the Judge's ruling, Alpha filed a post-trial motion seeking to have it amended, and the Judge promptly denied Alpha's request. On the other hand, although I have certain disagreements with the Judge's findings, I am not disappointed, and I believe that I have been vindicated by his ruling.

The ruling provides Alpha with the monetary repayment that I had been proposing and permits me to resume the business that I had contributed. That business will be resumed as Dovetail Surveys Inc. which will operate nationwide. The Dovetail staff and equipment have performed flyovers in hundreds of CATV systems coast to coast.

I thank you for this opportunity to express these facts.

Robert V.C. Dickinson
President
Dovetail Systems Corp.

I have just received your September issue and the accompanying special fiber optics supplement, and was pleased to see a familiar photo on the cover. However, my pleasure was soon dampened by the "About the Cover" mention on page 4, which credited the photo "courtesy ONI."

FYI, the photo is courtesy AT&T Bell Laboratories.

Robert B. Ford
AT&T Bell Laboratories, Short Hills, N.J.

Editor's note: Thank you for the use of the photo—I apologize for the incorrect acknowledgement.

CED *welcomes your comments. Send all correspondence to* CED *, 600 S. Cherry St., Ste. 400, Denver, CO 80222, Attn: Roger Brown.*

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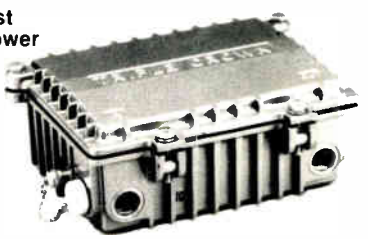

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Reader Service Number 15

Where did all the business go?

Construction forecast finds cautious optimism for 1991

After chugging along at record speeds for nearly two years, the engine that drives the cable-television construction train has suddenly run out of steam and stalled.

Scores of equipment vendors have watched in horror as the train derailed, taking their profits with it. These suppliers were left to watch, unable to deny the fact that at least a temporary end has come to the best thing to happen to them since the franchise wars of the early '80s have faded into history. The unexpected downturn has led to layoffs, furloughs and a variety of related cutbacks designed to ease the burden on suppliers' bottom lines.

Despite cable operators' history of cyclical purchasing patterns, this latest setback hit manufacturers and distributors especially hard because it was unexpected by most experts. Calendar year 1990 was looking like the best ever for hardware makers as operators were lining up to perform electronic upgrades and system rebuilds. Competition in the form of direct broadcast satellite (DBS) ventures and MMDS was knocking on the door, forcing lethargic cable systems to consider fiber optics and new equipment to improve picture quality and enhance customer service.

Down the tubes

But then, the bottom dropped out. Tele-Communications Inc., the nation's largest operator, locked horns with legislators who wanted to re-regulate CATV and publicly announced it was scaling back its construction schedule from approximately 8,000 miles of plant a year, to about 3,000 miles. While no other MSO joined TCI in that stand, clearly, something happened in the second half of 1990. As a result, companies that had cranked up production to meet the high demand were left in the lurch. For example, C-Cor Electronics expects to post its first quarterly loss in four years, after announcing record quarterly and annual earnings in August.

Not surprisingly, vendors lack a consensus when they attempt to explain why the business has nose-dived. Everything, including possible industry re-regulation by the government; tight lending policies created by the savings and loan debacle; early spending related to the July 1 signal leakage compliance deadline; as well as other factors, have been blamed by various players.

And, opinions vary as to how long the train will remain derailed. Optimists suggest a new calendar (and fiscal) year is all that's needed to get operators to spend again because competition is getting fiercer and the rebuild schedule is being driven by franchise expiration dates. But those who've been hit hardest have a hard time seeing the light at the end of the tunnel, insisting that 1991 won't be any better than 1990 and may in fact resemble the latter two quarters of 1990. Still other manufacturers insist their businesses have been left unscathed by the downturn are still healthy.

> 'There is nothing sick about our industry. There are some economic issues, but the industry is fundamentally in good shape.'

Who's right?

One theory

John Egan, president of full-line distributor/supplier Anixter Cable TV, theorizes that the industry is composed of a "food chain" and cycles in purchasing activity hit the various market segments at different times. For example, this latest episode of hard times affected construction equipment first, followed by coaxial cable, connectors and electronics. He adds that the final two segments, drop material and converters, are trending downward. Egan says construction equipment dipped for the first time in March of this year, followed 60 days later by cable.

To make matters worse, the setback isn't slight, says Egan. Depending upon the market segment, downturns of 25 percent to 50 percent have been experienced. And with only the fourth quarter of calendar 1990 left (historically the slowest quarter of every year), the near-term picture is "bleak, very bleak," Egan adds.

But Egan has taken a decidedly bearish attitude for all of 1991 as well. He believes the apparent failure (as of press time) of the industry to garner any regulation, combined with tight lending policy and rapid technological change all converged, for the first time in history, to create uncertainty in cable operators' minds. That uncertainty translated into fewer equipment purchase orders.

Of the three contributors, regulation remains the most oppressive, according to Egan. Personally, he hoped Congress and the industry would agree on some form of limited regulation. With that hope gone, Egan now believes lawmakers will concentrate their efforts in 1991 on a "fundamental review of communications policy" (read telco involvement). "I choose to think that's not good."

As a result, Egan predicts there will be an industry shakeout, with small producers finding it difficult to emerge whole. For its own part, Anixter has shifted personnel to healthy markets, slashed advertising and trade show spending and cut its distribution business to the bare bones. However, subsidiary companies Regal and ONI, which make converters, passive line equipment and fiber optics electronics, have been left largely intact, says Egan.

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Egan's view, there exists another who sees things very differently.

Top executives of the industry's two full-line manufacturers are decidedly bullish about CATV's health. Yes, they admit production has been outpacing purchase orders, but both Scientific-Atlanta and Jerrold Communications officials believe the fundamentals of the business remain strong. Cable operators are still hooking up subscribers, growing annually by 5 percent or more, they note. And CATV has historically been resistant to recession-related pressure, instead often growing because Americans stay home and watch more television during tough economic times. And, they insist, cable operators will continue to spend aggressively in 1991.

"There is nothing sick about our industry," says Hal Krisbergh, president of Jerrold. "There are some economic issues (affecting the short-term), but the industry is fundamentally in good shape." Krisbergh acknowledges that 75 percent of Jerrold's business is in subscriber gear, which has been strong, but he continues to feel good about his distribution business, too. He says that overall business has been trending downward, but "we're not falling off the face of the map."

Krisbergh and William Johnson, CEO of Scientific-Atlanta, both downplay the importance of regulation and its relation to capital spending. Johnson says that while those concerns are causing some construction reconsideration, he notes that the legislation proposed so far has been primarily palatable to the industry. He predicts that any other regulation that emerges could only be "better" because the Bush Administration has made public its opposition to legislation that would strangle an otherwise healthy industry.

Both men also agree that interest rates have climbed while lending policies have become more restrictive. But neither is worried about a recession: Johnson calls CATV "recession-proof" while Krisbergh notes that the nation's economy hasn't been "strangled" by the government to halt inflation, like it was in the early 1980s.

Call it something else

"There has been no fundamental change or shift in strategy by cable operators," observes Johnson. "This is just a pause, a digestion, or recalibration. The MSOs realize they cannot afford an extended period of non-investment in their plants. I think they realize that it's important politically to demonstrate they've improved their systems and customer service."

Johnson concedes that every S-A market segment has been impacted, though he declined to provide details. But his bullish long-term attitude translated into a different approach in his factory. Instead of laying off personnel, S-A opted to institute a one-week furlough of its production employees to reduce inventory—an action he says allows him to keep his "team" together. Johnson said the workforce took the decision "positively."

In general, Johnson blames the industry's hysteria about the slowdown on human nature—which often makes good times sound better than they are and slow times seem like depressions. "The trick is to look through the fire and smoke of the short-term and look

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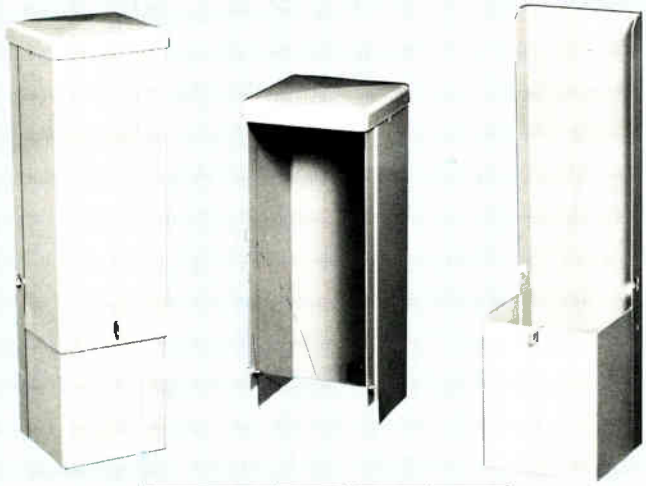

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Reader Service Number 17

at the fundamentals. The fundamentals are good."

In the meantime, vendors are doing everything they can to wait out the storm. Large companies with international presences have taken advantage of increased business abroad to fill in some of the gaps. While the overseas activity has been good, it cannot replace the domestic losses, however. And if the North American operating companies that have sparked much of the overseas action feel a real pinch, vendors may be back at square one.

Companies like S-A, General Instrument and Anixter, among others, which are also strong players in other markets, are squeezing every dollar they can from those business segments. For example, S-A's international network systems business is very strong, Johnson says.

The changing face of CATV

So, with the fact established that at least a portion of the industry's vendors are hurting, the question becomes, how long will the hurt last? Anixter's Egan, for one, believes CATV is in for at least a year of pain and he hypothesizes that the industry that emerges will be different than the one going in.

For example, the trunk cable market will be vastly different because of the popularity of fiber optics. ATC's much-publicized fiber trunk and feeder concept calls for much less coaxial trunk cable. Egan thinks its popularity will alter the trunk/feeder cable ratio from the traditional 3:1 to something much less. "The longer it takes (for that market) to come back, the less it will come back," says Egan.

Similarly, distribution electronics, long an excellent source of revenue, will be dominated by sales of low-priced line extenders, instead of high profit trunk stations. "People in that market will get slaughtered," predicts Egan.

With this Jerrold's Krisbergh takes issue. Because an entire plant rarely is wrecked out these days, Krisbergh says it'll be many, many years before passive networks supplant the huge installed base of trunk electronics. "It's not a robust growth market, but there's still plenty to do," he says.

Finally, addressable converters will remain a significant factor in the market for some time because interdiction and other outdoor schemes "won't be as far along as they hope," says Egan.

Other views

What do some of the smaller vendors think? Here, it's clearly a mixed bag. Niche or specialty product lines such as power supplies, drop material (including cable), test equipment and fiber optics gear all seem to have remained strong through the summer and up until the present time. Clearly the segments taking it on the chin are distribution electronics.

John Dahlquist, who recently joined Magnavox as its vice president of marketing, says his company has felt as much as a 20 percent drop in sales since August. But Dahlquist says the drop could have been much worse, except a new product offering gained Magnavox some valuable market share. In response, Magnavox reduced forces through attrition and layoffs of personnel with less than 120 days of service.

Dahlquist believes the market died because many operators spent their capital budgets in the first half of the year in order to beat the signal leakage deadline. He also predicts the market

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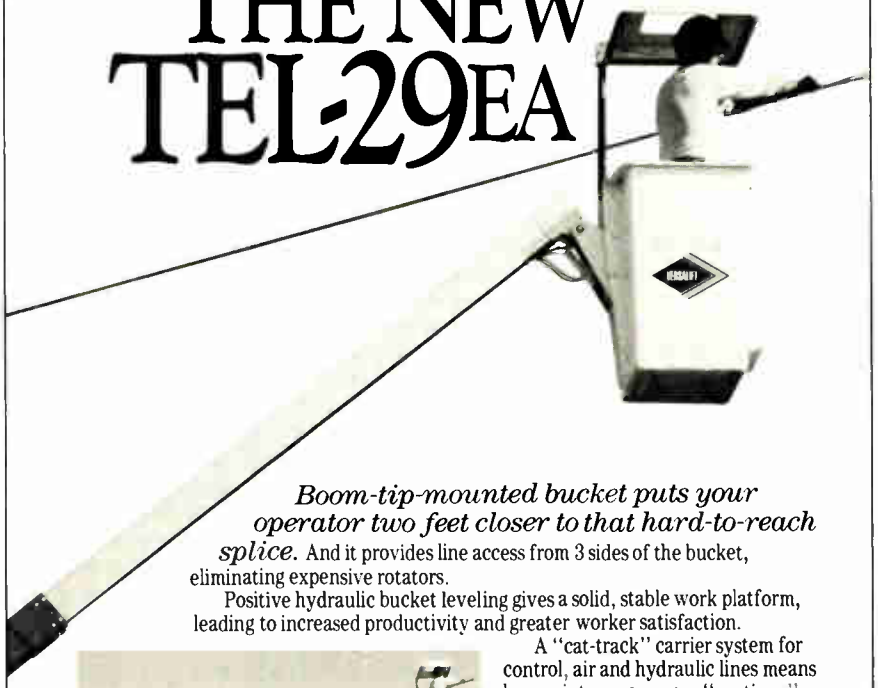

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will return to a more predictable level within six months, driven by operators' need to remain competitive for the video entertainment dollar. While he doubts 1991 will top 1990 as Magnavox's best year ever, he remains keenly optimistic.

John Hastings, the friendly national sales manager at C-Cor, has seen so many of these lapses in spending, he takes them in stride. Ever optimistic, Hastings is fearful of predicting impending doom, believing those prophesies are often self-fulfilling. Instead, he says the industry will bounce back because it's fundamentally a good business.

However, Hastings admits the regulatory picture will have to get clearer and the economy will have to bounce back before the industry can make a complete recovery. Regardless, his hunch is that pent-up demand will kick-start the capital spending once again by the second quarter of 1991.

The regulatory picture will have to get clearer and the economy will have to bounce back before the industry can make a complete recovery.

Hastings is one who believes the signal leakage compliance deadline actually put off more spending than it spurred. He surmises that small operators who struggled to meet the deadline concentrated on tightening their existing systems and put off system upgrades until next year.

But unlike previous downturns, this latest one has Hastings scratching his head. "I can't figure out what's real and what's imagined" he says. "I'm not sure it can be easily explained by focusing on the economy or regulation. That doesn't explain why everyone withdrew." He admits, however, that TCI's action spooked many operators into freezing their spending for the year.

Consequently, C-Cor is looking at a financial loss for the first time in four years. However, some of that could be

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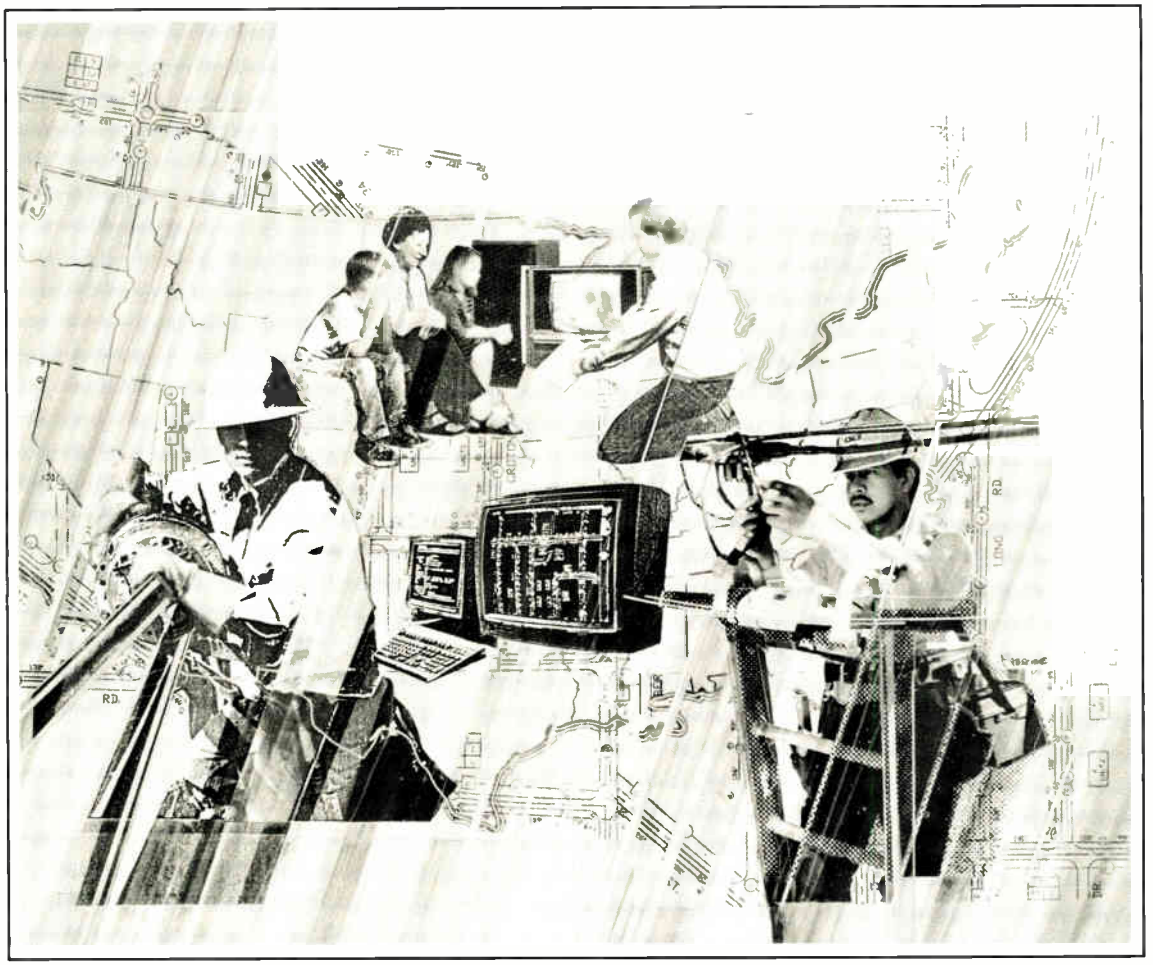

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Reader Service Number 20

Survey finds MSO 1991 construction plans flat

Major MSO new and rebuild construction plans for calendar year 1991 are flat at best and will most likely be slightly off the levels set in 1990. Whether that's good news or bad depends on whether spending matches the Dr. Jekyll first half or the Mr. Hyde second half. As the year winds to a close, officials at Jerrold Communications, who had been selling record volumes of distribution gear early in the year, found that business "hit the wall in July," said Geoff Roman, Jerrold vice president. "We went nuts the first six months of the year" before sales went over a cliff in mid-year, Roman said.

As a result, Jerrold's tally of the year's bizarre pattern of activity will resemble the typical scoring activity for recent Denver Broncos football games: a shootout in the first half and woeful performance in the second half. "Better than 75 percent of all annual volume probably was shipped in the first half," said Roman.

Based on surveys of 16 of the 25 biggest MSOs, *CED* found that half of the operators, including Cox Cable, Viacom Cable, American Television & Communications (ATC), Warner Cable, Maclean Hunter, Adelphia, Heritage, Continental Cablevision and Jones Intercable, expect to build fewer miles in 1991 than in 1990, although some of the MSOs, such as Adelphia, Jones, Viacom and Cox, anticipate a level of activity only slightly less than in 1990, possibly on the order of a few hundred miles less construction in each case.

Bigger drops, though, can be expected from Warner Cable and ATC. In Warner's case, activity will drop sharply simply because that MSO 20has finished upgrading 80 percent of its plant over the past several years, said Brad Johnston, senior vice president.

ATC officials wouldn't disclose anticipated construction figures or the degree of change, but sources indicate ATC will build 2,000 miles of plant in 1991 compared to 2,500 miles this year. But, electronic upgrade mileage could range as high as 7,000 miles, bringing the ATC total up to 9,000 miles.

Tele-Communications Inc., which shut off the capital spigot early this year, won't budge in 1991 either, and will build about less than 3,000 miles, down sharply from the 8,000 to 10,000 miles it typically builds in a year.

Telecable expects to build 550 miles next year, identical to its activity this year. But, several of the operators polled plan to step up construction in 1991. Sammons, for example, will increase from 1,000 miles to 1,300 in 1991.

Comcast also will be up from 4,248 to 5,110 miles while Scripps Howard increases its construction total from 800 to 1,150 miles. Newhouse also will increase its spending, increasing the miles of plant built from 400 miles this year to 900 miles next year.

In fact, Newhouse, which typically builds about 400 new plant miles a year, will start early in 1991 on rebuilds of three systems representing 3,000 miles that will last four years, said Joseph Majczak, vice president, engineering. Work should begin at two of the systems at a 50-mile-per-month clip, said Majczak.

Except in the case of TCI, uncertainty about the regulatory situation doesn't seem to be a major factor in each MSO's capital spending plans. And capital availability, while certainly an issue for smaller operators, does not appear to be a primary concern.

Indeed, the reasons for the caution are quite disparate. TCI, for example, sits in a uniquely thorny seat. Having been specifically named as a potential target for breakup by some solons, top officials at the nation's leading MSO say they are restrained by the possibility of shareholder suits should any legislation emanating from Washington result in a corporate dismembering.

None of the other MSOs polled, by way of contrast, cited regulatory uncertainty as a key factor in their decisions.

TCI's stance on capital expenditures at other operating companies in which TCI has a financial interest may vary. At operations such as Heritage, for example, TCI takes a "hands off" attitude. That's because the management contract in place specifically allows Heritage managers to set their own goals and rewards them for meeting or exceeding those goals, said Dave Willis, TCI director of engineering.

On the other hand, Willis also guessed there would be some ripple effect on many of the other companies where such management contracts aren't in

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Reader Service Number 21

traced to the recent takeover of Comlux and the move into a state-of-the-art manufacturing facility. It has also led to some creative marketing: C-Cor is giving operators an extra month to pay for equipment they order. The extended payment plan gives system operators until January 31, 1991 to pay for gear they order before December 31, 1990.

Into the home

That spending freeze is beginning to reach into the subscriber's home, too. Although converters have become a poor indicator of construction activity because many upgrades do not consist of converter change-outs, David Nicholas, director of sales at Pioneer Electronics of America, is cautiously optimistic his business will be spared from the ax cutting.

Nicholas says he hasn't seen any business slowdown yet and hasn't heard anything that would make him believe he'll see significant drops in sales. "We feel confident we'll have a good year," he says.

Conversely, Regal Electronics has felt the pinch and President Mike Armstrong says 1990 won't finish well, even though he's selling half a million passives (mostly taps and splitters) per month—a sure sign cable systems are still hooking up subscribers. But Armstrong is looking forward to next year, when Regal will roll out its off-premise interdiction device and spur new sales. When the logjam is broken, equipment vendors will again struggle to ramp up production and meet the demand, predicts Armstrong.

It is exactly that market volatility that may lead to the demise of some of the industry's smaller players. Anyone who was caught making an expensive transition from a small company to a larger one may get caught in a tailspin he can't pull out of. Depending upon how long this situation lasts, it could be tough, uphill sledding for some.

But as many observers note, the problems cannot last long. With roughly 50 percent of the nation's plant mileage at least a candidate for a rebuild or upgrade over the next five years (driven by franchise renewal dates), manufacturers and suppliers should be planning on how to react when the next great demand commences. Because, like the "little train that could," the cable-TV train will again take capital spending to the top. ■

—Roger Brown

place. Most likely, there would be some scaling back at these business units, Willis speculated.

ATC and Time Warner, both of whom will reduce their capital spending for plant, have different reasons for doing so. ATC probably will feel the pressure of debt reduction efforts associated with the Time-Warner merger. Warner simply is at the end of a major round of plant upgrades.

Fiber projects are slated for an increase, however, even at companies with plans to scale back overall construction. TCI, for example, intends to install 680 strand miles of fiber at 17 systems.

Cox Cable, which installed 49 AM receivers and 175 route miles of fiber this year, intends to put 177 AM receivers into the field, adding 550 strand miles of optical cabling, in 1991.

Telecable also intends to be aggressive about AM optical gear, installing gear at "seven or eight different systems," said Larry Schutz, Telecable spokesman. Telecable does plan to install some fiber-to-feeder networks but also will use optical supertrunks to consolidate headends or chop amplifier cascades in other cases.

—Gary Kim

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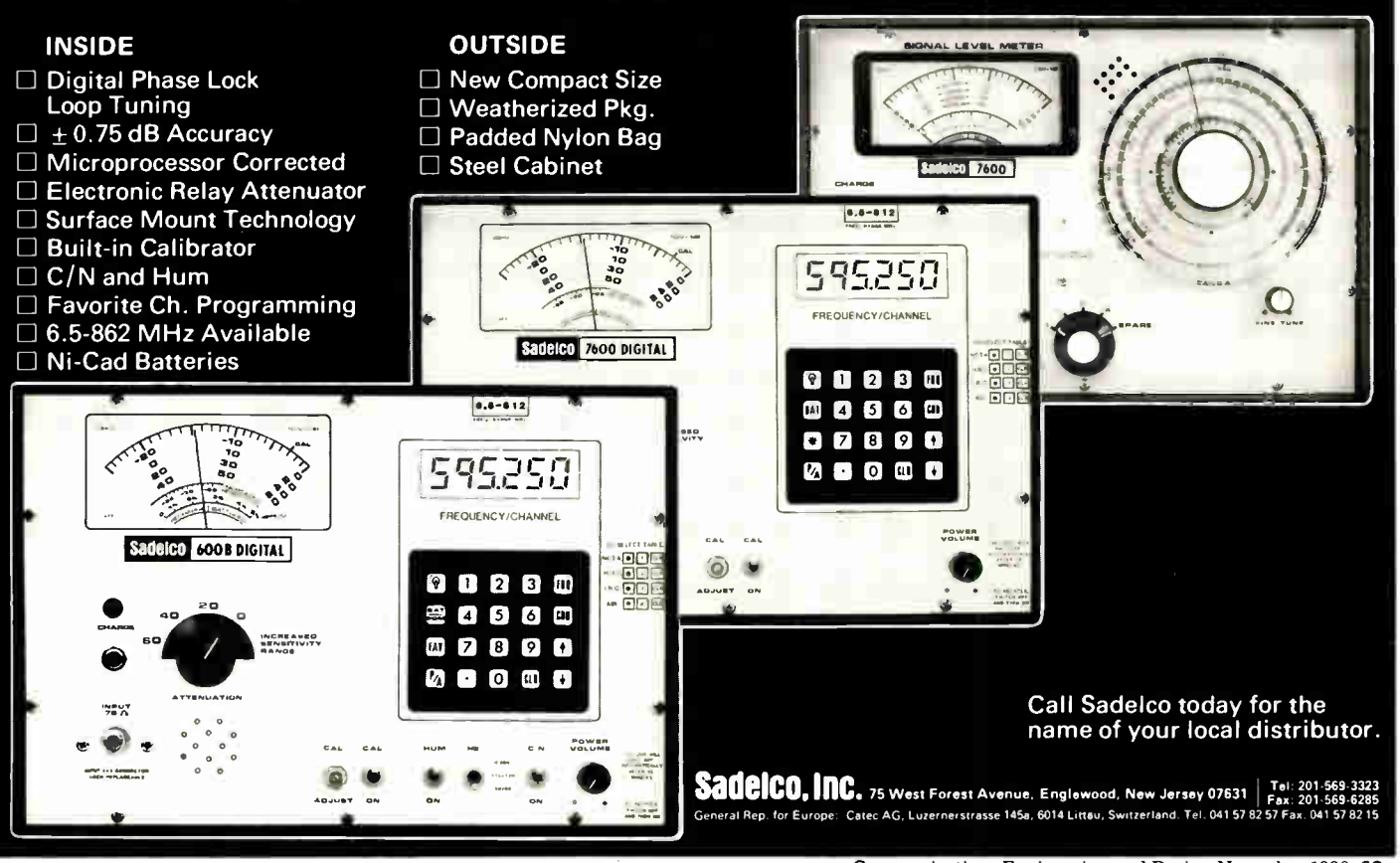

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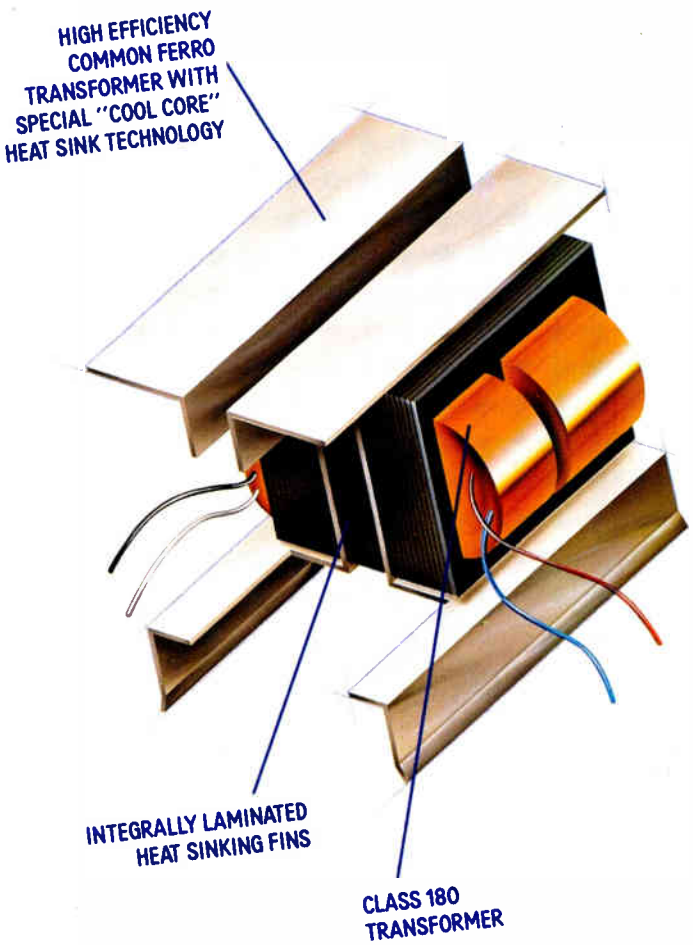

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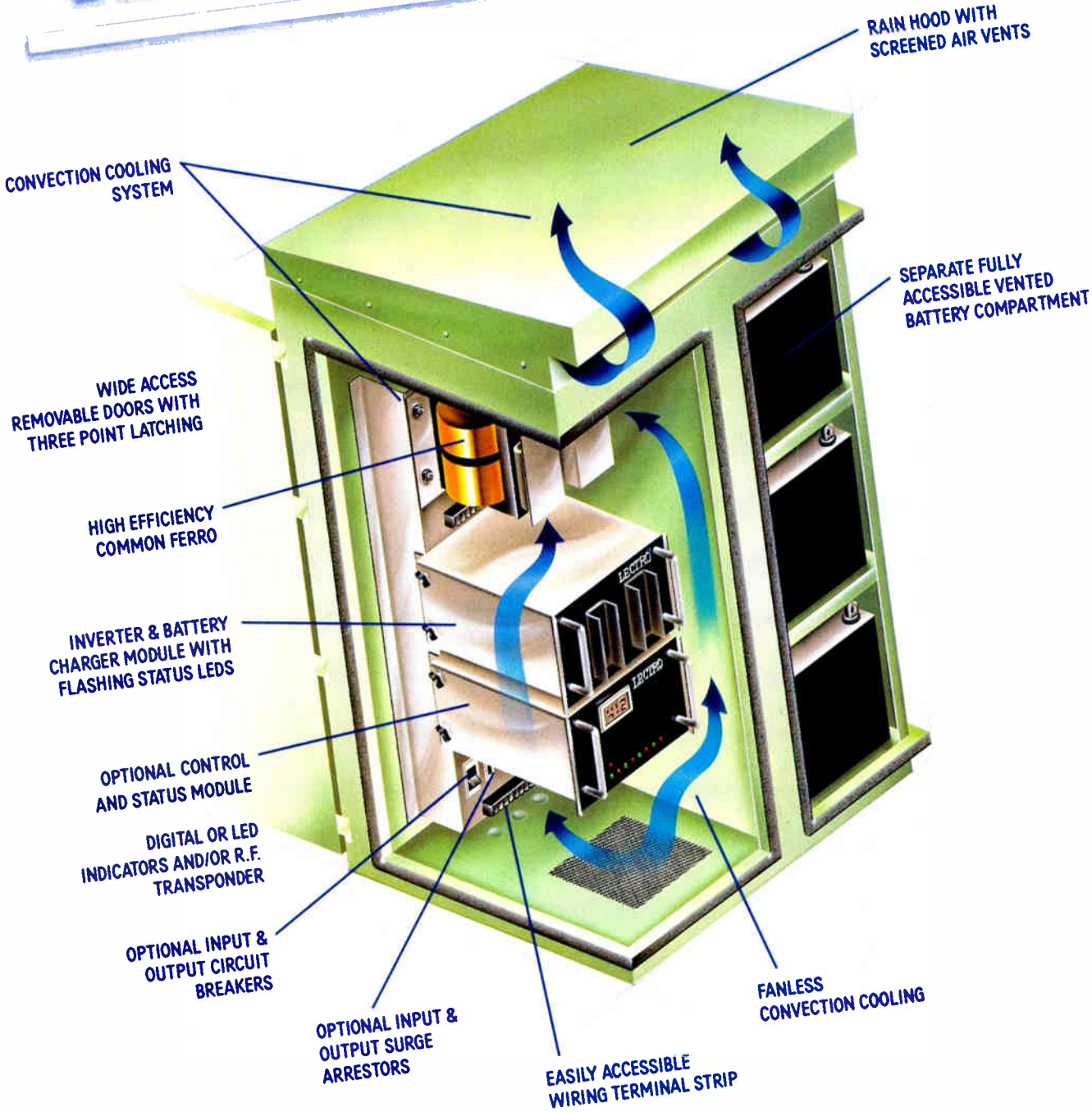

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Reader Service Number 24

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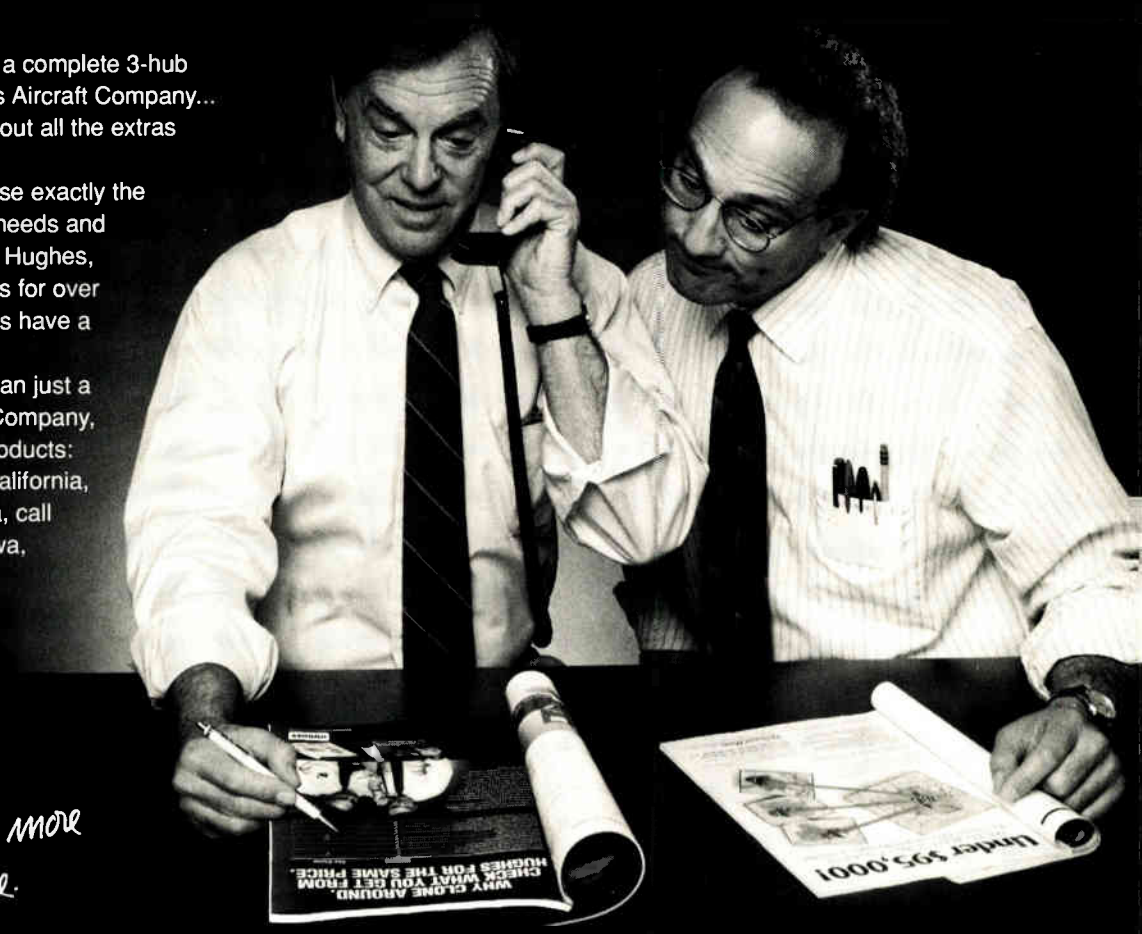

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Reader Service Number 25

Emergency fiber restoration

The CATV industry has quickly embraced the technology of fiber optics. With this advanced technology comes new requirements for maintaining and ensuring the reliability of the CATV operating system. Although the concept of having a maintenance and restoration plan is not new to the industry, there are unique issues and needs that must be addressed when dealing with a fiber optic cable system.

Fiber optic systems are becoming more economical and practical for CATV applications, but how does the use of fiber optics affect system maintenance and reliability? Fortunately, the CATV industry does not have to wait for their cable systems to age 10 years to get this information. Fiber optic cables have been used in the telecommunications industry for over 12 years and several studies have been made on installed fiber optic cable showing them to have excellent reliability.[3,5]

As an example, Table 1 provides a summary of the system incidents affecting a portion of MCI's optical cable systems between December 1984 and January 1986. The failures were all extrinsic and fell into two basic categories: man-made and environmental. A significant portion of the system incidents fell under the man-made category and were caused by cable cuts due to parallel construction or dig-ups. Although cable systems are designed to be as rugged and reliable as economically possible, some extrinsic failures are unavoidable.

The electronics issue

One study concluded "that the existing data on the frequency of copper cable cuts in a given service area can be applied to fiber optic cable cuts."[3] This type of logic should be transferable to the CATV industry and give the operator an indication of the minimum level of reliability for the optical cable system. In fact, fiber optic cables generally are more rugged than their coaxial cable counterparts and will in all likelihood provide equal, if not better, reliability.

By Mike Genovese, Product Manager, CATV and Utility Prods., Siecor Corp.

But what about the electronics? We do know that in recent years DFB lasers have been used extensively in telephony digital applications and have shown outstanding reliability, but there is little experience with using lasers in the current CATV AM applications. Recently, one lab study focused on the effects of accelerated aging on DFB lasers. The study indicated the DFB lasers currently used in AM fiber systems can provide the performance and reliability needed by the CATV industry for a median life of 25 years.[1] If this is indeed true, then the biggest reliability issues for the company's fiber optic system are uncontrollable extrinsic failures like pole breaks, dig-ups, etc. Given this assumption, having a well-defined system maintenance and restoration plan could significantly improve a system's reliability.

Table I
Fiber Optic Reliability
MCI (Dec. 1984-Jan. 1986)

Sheath - km	5300
Sheath - km	23,000,000

Traffic Affecting Incidents

Description	Number
Parallel Construction	6
Contractor Activity	1
Backhoe, Auger, Digging	3
Gunshot	2
Hurricane	3
Flood Damage	1
Ice Crush (Bridge Crossing)	1
Vandalism	1
Total	**18**

First, the operating company must decide what level of maintenance and restoration capability to have. The company may want to maintain and restore their fiber optic system themselves, or may wish to contract out certain portions to contractors who specialize in fiber optics. This decision is a philosophical as well as an economic one. For the purpose of this paper, we will assume the CATV company will have complete in-house capability.

There are two planning phases to consider with regard to maintenance and reliability of a fiber optic cable system: Pre-installation and post-installation.

Pre-Installation

Although the system's equipment and materials are not always considered a part of the maintenance plan, the selection of system products can have a long-term effect. The operator should choose products that meet industry standards to ensure that the installed system will perform consistently over its expected life and provide the needed reliability. Standards for optical fiber, cables and associated products have been developed and used in the telecommunications industry for over 10 years.

While performance and cost are usually considered the key parameters of planning a fiber optic system, the system design can have a major impact on the system reliability. With today's watchwords being "customer service," and "reliability and quality," it is imperative to design CATV systems that enhance reliability. Such features could include advanced monitoring and control systems, fatigue and abrasion resistant optical fibers, backup coaxial systems/AML systems (usually already installed), diverse optical cable routes and 1 x N laser protection with optical switches.

Post-Installation

A CATV system's "Maintenance/Restoration Plan" should address five key elements: equipment/materials, records, personnel, training and restoration procedures.[2] We will examine each individually.

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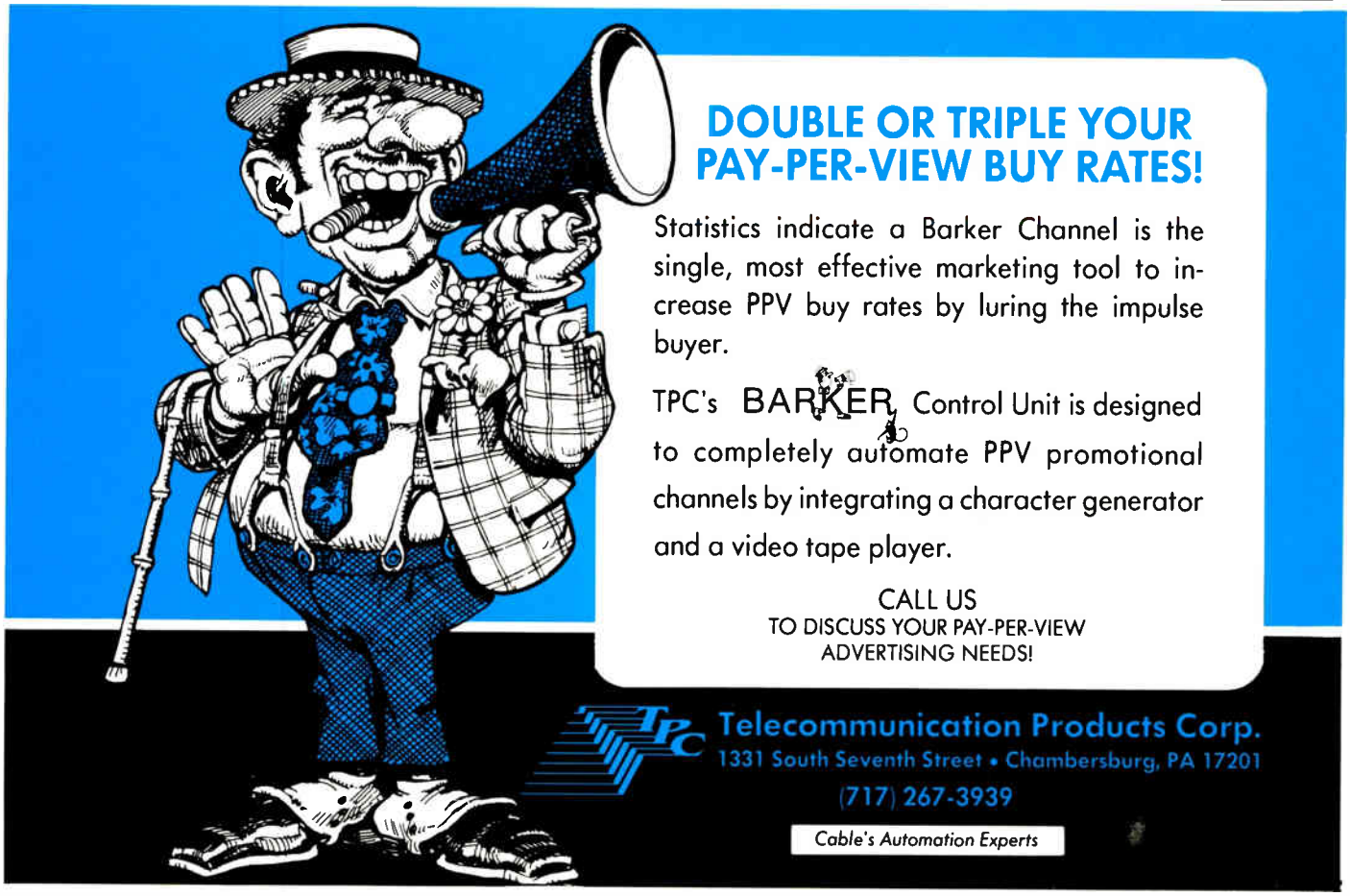
increases 10-fold. Purchasing the proper tools is just part of it; having the tools readily accessible is just as important. One method for accomplishing both of these objectives is to have an Emergency Restoration Kit (ERK™), containing all the needed tools and materials for repairing an optical cable system at the restoration site. A typical kit should include:

- Optical cable: The restoration cable should have the same fiber count as the highest fiber count cable in the optical cable system. It should also be of sufficient length to span the longest pole span distance of the system, plus slack for splicing (typically add 100 feet). If the system contains ducts or manholes, the restoration cable should be of sufficient length to span the largest distance between manholes, plus slack for splicing (typically 75 feet). With buried cable, there is usually more flexibility in locating the new splice points.

Note: Keep in mind that certain types of depressed clad single-mode optical fiber are susceptible to modal noise if the two adjacent splice points are less than 20 meters apart.[6] Consult your optical cable manufacturer to determine if this is a concern for your system.

Typically, there is a restoration cable reel in addition to cable used in the restoration kit. The restoration cable reel should contain about 2,500 to 5,000 feet of optical cable, and should have the same fiber count as the highest fiber count cable in the system. It should be centrally located and clearly marked so that it is not installed into another portion of the operator's system by mistake.

- Splice closures: Two ready-to-use closures should be included in the kit. The operator should choose splice closures that have sufficient capacity for the restoration cable, and that are easy to splice in, seal and re-enter.
- Splice trays: There should be a sufficient number of single-mode splice trays placed in each splice closure to route the buffer tubes of the restoration cable. The operator may wish to consider using splice trays that are designed for both mechanical and fusion splices. This way, the transition from the temporary mechanical splice to the permanent fusion splice will be much easier.
- Mechanical splices: The splice should be fast and easy to use. Typically, mechanical splices that accept cleaved fibers and require no epoxy or polishing are the fastest and easiest to install. The goal is to get optical continuity as quickly as possible, while achieving a reasonably low splice loss. The advantage of the mechanical splice is that the restoration cable can be stripped, loaded into the splice trays and have the splice installed on each fiber prior to an emergency ever occurring.
- Optical power meters: At least one optical power meter should be included in the kit so that the output power of the lasers at the headend and/or at the receiver can be measured. Inexpensive handheld power meters are readily available that can measure wavelengths at both 1310 nm and 1550 nm. To measure the output power of a bare fiber, the power meter should be equipped with a bare fiber adapter.
- Optical fiber cleavers: The kit should contain two fiber cleavers; one for each restoration crew member. The cleavers should be handheld, rugged and require no external power supplies.
- Miscellaneous tools/materials: Additional items for restoration include sheath knives, wire cutters, isopropyl alcohol, tissues, electrical tape, tywraps, silicone RTV, Gel Off, etc.



Reader Service Number 27

For those optical cable installations that are connectorized at the fiber terminations, the restoration team should maintain a supply of connectorized pigtails, connector sleeves, etc. Connector tips can be easily scratched or damaged if mishandled, and are a common source of increased system attenuation.

To set up the restoration kit, the restoration cable should be fully prepared and installed into the two splice closures. The buffer tubes should be routed to the splice trays and the optical fibers should be prepared and installed into one side of the mechanical splice parts. This preparatory work will save about 1.5 man-hours of on-site restoration work and will enable the operator to bring up the fiber optic system that much faster.

There are other tools and equipment needed for troubleshooting the fiber optic system from the headend or hub, including an Optical Time Domain Reflectometer (OTDR). This extremely versatile piece of equipment operates on the same principle as an electrical TDR, but is used only on optical fiber. The OTDR can measure splice loss, detect system faults, measure system length and estimate the system's link loss. This is an essential piece of equipment for any operator responsible for maintaining a fiber optic system.

Records

Complete and accurate records are invaluable for the troubleshooting and restoration of an operating system. It is important that the records be functionally organized and located in a designated place for easy access. Duplicate records should be kept in an alternate place to prevent accidental loss of this valuable data. Typical fiber optic system records should include:

- Route/cable plan with cable feet or meter marks. Be sure to record any places where excess cable slack is stored. This will be a factor when using an OTDR to determine the geographical location of a cable fault.

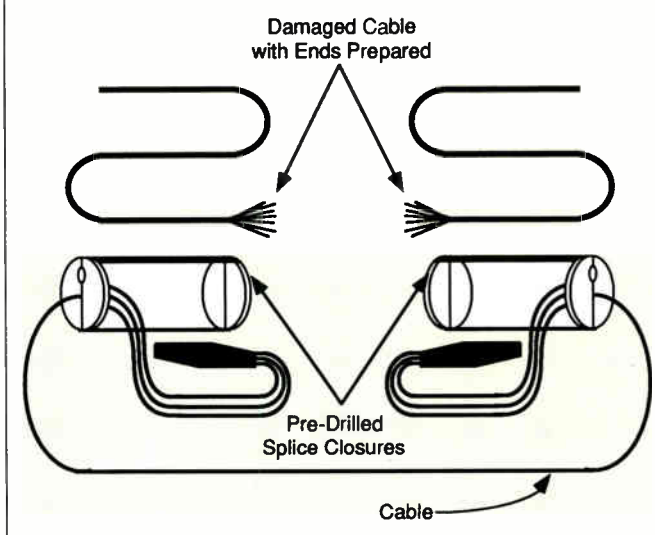


Figure 1

- Splice plan detailing fiber assignments, splice locations and restoration priorities.
- Splice loss data.
- Transmitter output levels.
- End-to-end system attenuation.
- OTDR signature traces.

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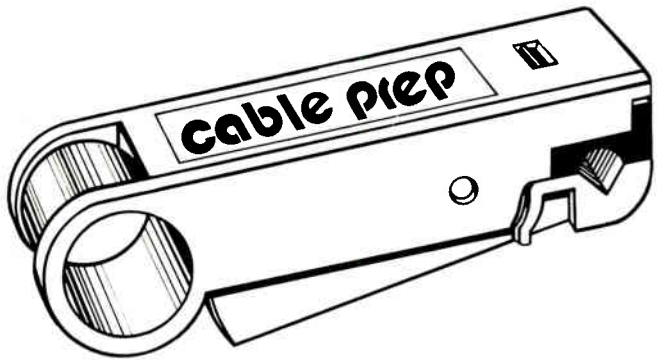

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Reader Service Number 29

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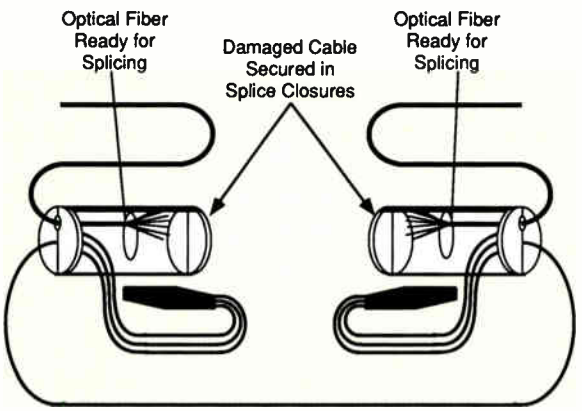

Figure 2

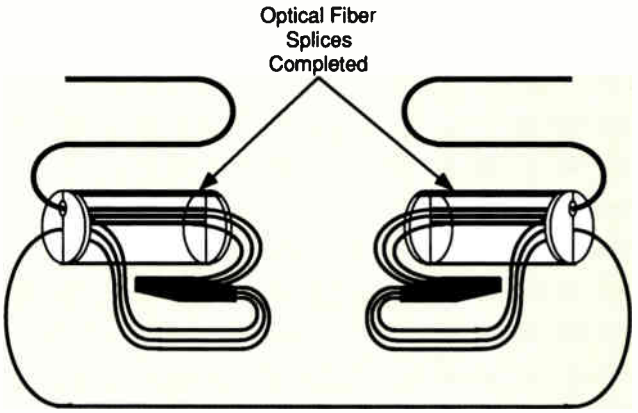

Figure 3

ture trace can also provide an estimate of system attenuation.

Checks and calibration of test and troubleshooting equipment.

Note: The record requirements listed above are for the passive optical cable system only, and provisions should be made for documenting the performance of the system's electronics as well.

Personnel

The operator must designate which personnel are responsible for maintaining and more importantly, troubleshooting and restoring the fiber optic system. As with any new technology, there will be gaps of knowledge and experience within the company. Properly trained personnel should be given specific task responsibility for testing, troubleshooting and restoration of the fiber optic system. In addition to these responsibilities, the designated personnel should have responsibility for maintaining the emergency restoration materials and equipment. Also, the maintenance plan should have provisions for how designated personnel will be notified when an emergency occurs, and how they can access system records.

Cross training vital

It is important to note that it is very easy to end up with an elite "fiber team" in the company. Although this may be a functional necessity at first, in the long run, it will be to the operator's advantage to cross-train as many personnel as possible in fiber optics to give flexibility to scheduling and emergency restoration task assignment. Thus, training of the personnel is the next critical link in the mainte-

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nance and restoration plan.

The initial training required by a restoration team begins with ensuring each team member practices proper safety procedures. During a time when speed and accuracy are critical, it is also very important that team members remain injury-free.

System repair begins with the identification and location of the system failure. To do this, team members must learn the skills necessary to operate equipment such as OTDRs and power meters.

Once located, the fault must be repaired. This may involve replacing anything from a damaged connector to a link of cable. So the team must be well versed in all possible solutions. Proper cable handling procedures, hardware preparation, mechanical splicing and fusion splicing are vital and necessary skills in the event a system repair is needed. A maintenance and restoration plan isn't worth the paper it's written on without well-trained personnel to implement it. It is recommended that the initial classroom training include some basic theory as well as extensive hands-on training.

Cross training of personnel is also important. The ability to perform more than one task will prove beneficial in the event that one team member is not available when an emergency occurs.

Refresher training is equally important and should not be overlooked. As personnel changes occur, the replacement personnel will require the same sequence of training to ensure a smooth transition of responsibilities as well as stability of the system. Refresher training ensures that old skills remain sharp and new skills are implemented. For emergency restoration, refresher training is best done with a combination of classroom training and mock restoration drills once every six months.

Restoration procedures

This is where the fun starts. It's 1:30 p.m. on Super Bowl Sunday. The headend technician has just discovered that the status monitoring system indicates a loss of optical and backup coaxial transmission to the hub. This hub just happens to be the largest one in the system and provides service to the city mayor. What should happen?

Step 1: Commence troubleshooting. The headend technician should inspect the appropriate system electronics to see if the failure has occurred there. If the laser(s) are putting out the proper optical levels and all RF levels to the laser(s) meet specification, then the next step is to inspect the optical cable system.

Step 2: Test cable system. The technician should take the OTDR located in the headend and obtain an OTDR trace of the optical fiber. The trace should be compared to the original signature trace to see if any abnormalities exist. Let's assume that the OTDR indicates a fiber fault. The OTDR will give an approximate distance from the headend to the fault. By comparing the distance given by the OTDR to the cable route diagrams, the technician can estimate the geographic location of the fault. At this point, the headend technician should notify the designated emergency restoration team of the cable system fault and its approximate location.

Step 3: Site evaluation. The emergency restoration team arrives on site with its restoration kit, safety equip-

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ment, access ladders, etc. It finds a little old lady from Pasadena with a 1969 Cadillac has knocked down a large tree and although the lady is fine, the aerial coaxial and fiber optic cables have been severed. It is now 3:30 p.m. and the Super Bowl starts in less than three hours.

Step 4: Cable restoration. The restoration team should inspect the damaged cable and cut out the damaged section plus an additional 10 feet on each side in case there are any optical fiber offset breaks; i.e. where the fiber breaks relative to the actual cable break. In this case, the team decides to run its restoration cable along the ground next to the street until the broken steel strand is replaced.

The following is a sequence of cable restoration by at least two restoration team members working simultaneously and using a restoration kit:

Prepare the damaged cable ends for installation into the splice closures (See Figure 1).

Route the buffer tubes of the damaged cable into the splice trays (See Figure 2).

Consult the emergency restoration plan and mechanically splice the high priority fibers first (See Figure 3).

Check with the headend technician to see if the status monitoring alarm has cleared. Once cleared, continue splicing the remaining fibers. The splice closures can be temporarily sealed until the permanent fusion splicing can be done.

It's now 5:50 p.m. and the Super Bowl starts in 10 minutes. Your customers are celebrating the quick return of their CATV service.

Summary

As the use of fiber optics gathers wider acceptance and application in the CATV industry, the importance of a maintenance and restoration plan will also grow. The 12-plus years of fiber optic experience in the telecommunications industry indicates that fiber optic cable systems are reliable and that most system failures can be attributed to uncontrollable, extrinsic failures. By having a well-defined maintenance and restoration plan, the operator will have the ability to swiftly identify system faults and act on them, thus quickly restoring service to the customer. ■

References

1. Flynn, E.J., et al. "Performance and Reliability of Laser Devices for CATV." SCTE Proceedings March 1990; 167.
2. "Maintenance/Restoration Training Course." Siecor, June 1989.
3. Szentesi, Otto I. "Reliability of Optical Fibers, Cables and Splices." IEEE J. Select. Areas Communication, vol. SAC-4, No. 9, December 1986; 1502-1508.
4. Kiss, L. "Performance of Optical Fiber Cables and Operations and Maintenance Procedures in the Australian Telecommunications Network." International Wire & Cable Symposium Proceedings, March 1983; 212.
5. Ishio, H. "Japanese field trials and applications in telephony." IEEE J. Select. Areas Communication, vol. SAC-1, April 1983; 404-412.
6. Sear, F.m., et al. "Probability of Modal Noise in Single-mode Lightguide Systems." 100C-ECOC 1985; 823-826.

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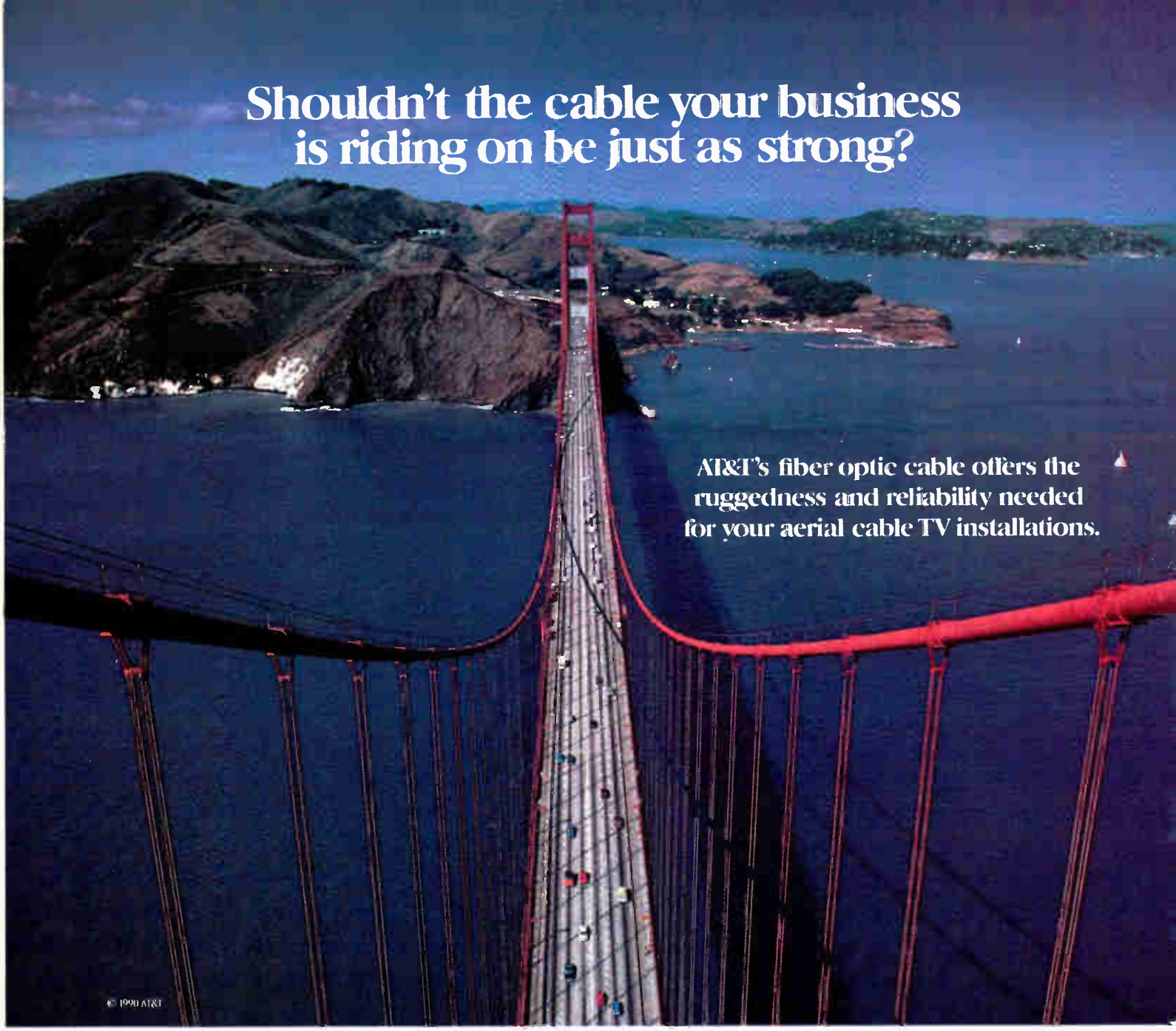

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Home automation and cable television

Part II—The markets

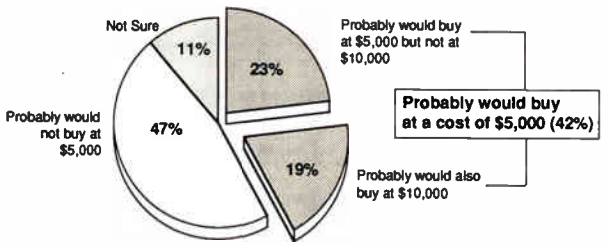
Around the world, especially among the more affluent members of developed societies, there is pent up demand for automation of the home as evidenced by a spate of recent articles in magazines such as Popular Science, Scientific American and The Readers Digest. There's even a magazine, Electronic House, devoted to the subject.

Reflecting this developing demand, there continues to be standards setting activities underway. There is the Home Bus System (HBS) supported by the consumer electronics industry in Japan. The European Commission is developing the D2B standard for member nations. South Korea is specifying a standard after a product developed by Cliff Schrock of CableBus called CDT-8/4. It takes into account the EIA RS-485 standard used in the telemetery business. "It was a resounding thud in the United States," says Schrock, "but Korea is pursuing a manufacturing license (for domestic use)."

At the coming Winter Consumer Electronics Show, an international group will meet to hash out possibilities for a single world standard. In the United States, the Electronics Industry Association (EIA) has the CEBus Committee overseeing standards setting by various subcommittees, each taking responsibility for separate industry areas.

But there is another entity in the U.S. developing technology called Smart House, and they have a grand scheme for automating newly constructed high-end homes.

Likelihood of Purchasing New Home With Home Automation System Installed



A. "Suppose you were building or buying a newly constructed home and were offered a system that included many of the features we have been discussing - energy savings, enhanced security, scheduled lighting, telephone as intercoms and so forth. If this system were to add an additional $5,000 to the cost of your new house, do you think you would probably buy such a system or probably not buy it?"

B. "Suppose the system cost $10,000, do you think you would probably buy it or not buy it?"

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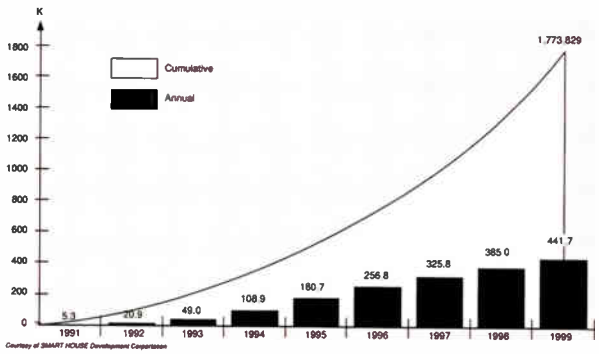
Figure 1

Smart House Sales Forecasts
Single Family Market



Courtesy of SMART HOUSE Development Corporation

Figure 2

Integrated Home Block Diagram

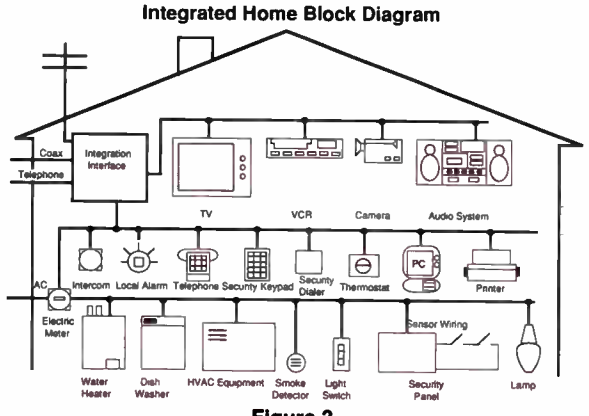


Figure 3

By George Sell, Contributing Editor

Smart House seeks to capture the entire home automation infrastructure within its net regardless of outside industry standards. Even the appliances in the home have to be designed with Smart House chips. With the original design, the purchase of a new Smart House would mean consigning all standard appliances to Good Will—from refrigerators to power drills—because they couldn't operate in the new home.

Smart House technology is designed overtly to dictate the grand marketing scheme they have in mind. "What they would like for you to have is eventually all Smart House based appliances," says Mike Cogbill, senior technical editor with Parks Associates (a Dallas research firm specializing in the home automation field) and author of their recent book, An Overview of Worldwide Home Automation Standards. "How they are going about getting there has had to change from the original design."

Smart House marketing

The Smart House market strategy is, in the first thrust, to approach the residential construction industry, the home builders, rather than concentrating on the consumer electronics engineering communities, as CEBus is. "The project, of course, was founded by the NAHB, their National Research Center, and the angle for which it was started was the opportunity to advance construction in the residential market," says Chuck Gutenson, executive vice president of Smart House. The NAHB National Research Center typically does studies of structural designs, installations and bathroom fixtures. This is their first

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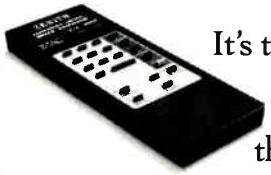

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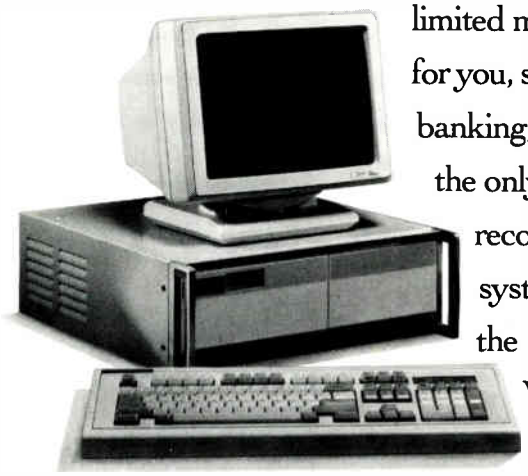

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step into electronics.

"Many products that make their way into residential construction on a large scale start with new construction, where the acceptance of price levels is higher because you can embed costs in mortgages," Gutenson argues.

But if you are a company that wants to set foot on Smart House's turf, you have to sign a Research and Licensing Agreement and pay, up front, what they think is a reasonable percentage of your expected royalties—as high or higher than $50,000.

Smart House will build the backbone in-home wiring system and the central controller that links it all together. Then, interface chips will be designed to conform to that system. These chips will go to the Smart House member vendors of attached products such as washing machines, TV sets, dishwashers, lights, security centers, all the variety of things that attach to the backbone system and make them operate, interact and communicate.

Smart House will take no more than three R&L agreeing vendors in each product category. "What that will do is give these guys a jump on the market," explains Cogbill.

Smart House has had to back away slightly from the technology of the original grand scheme. The original unitary hybrid cable design included power, coaxial, twisted pair, and gas lines. This could be tapped into with a special toothed clamp that would pierce the jacket and establish the tap. This all proved to be technically questionable, price prohibitive, potentially unsafe, difficult to work with and too, too big—so big that when it was run into the home, the hole cut into the studs left them unable to support the structure. Currently, Smart House specifies three cables.

Closed-loop power was another early safety standard feature, but this meant the potential homeowner had to buy complete systems. It's now offered as an option. "The cost of the system they originally designed was over $12,000 and all that got you was the backbone," says Cogbill. "Then you had to go buy all the right appliances to make anything happen."

> Parks Associates believes that *SMART HOUSE* forecasts are too aggressive. The number that it projects as its own market is larger than the central controller units we forecast for the total market by 2000. The probable reason for our differing forecasts is different timing theories. *SMART HOUSE* believes that it can explode this market once it's out due to faith in its builder support.

One wonders if the Smart House strategy is naive as well as idealistic, since the consumer electronics industry is interested in mass market and Smart House seems to offer them a niche market. "We are going to liberalize the conditions [of the R&L agreement] a bit. We expect that that will remove the complaints," Gutenson says.

"I think that when talking about electronics or communications," says Claude Baggett, director of consumer electronics systems at Cable Labs, "anything that doesn't directly involve the consumer electronics industry is probably a lost cause."

"I think the big consumer electronics companies would go after a smaller niche market, in a lot of cases," comments Joe Van Loan of Cablevision Industries and a former consultant to Smart House, "if the number of units is on the order of a quarter of a million annually."

According to figures developed by Parks Associates, U.S. private annual single family housing starts average about one million each year. They assume the homes that qualify for Smart House applications are the $200K plus homes, which accounted for 17.3 percent of the market in 1989. They project this category to rise to 21.9 percent by 1994 and to 25.4 percent in 2000.

One way they look at the market is to project revenue figures for the home automation controllers. Parks sees the end-user market value to be $766 million by 1994 and growing to $2.01 billion by 2000. The total dollar impact of such systems is expected to be approximately three times the controller revenue. Therefore, according to Parks Associates, a total market value of $6 billion by 2000 may be realistic.

But even if Smart House lowers the entry barriers for vendors, wouldn't manufacturers have to produce two product lines for the same appliance? On the other hand, CEBus standards seek to use available home technology and follow a plug-and-play philosophy. With this approach, consumer electronics manufacturers may be able to develop their full product line, do mass manufacturing and not have to worry about a separate product line that conforms to a smaller niche market—which may or may not turn out to be successful.

"Well, I don't see it as a niche market. I see our strategy as being one that gets to all of the markets before we're finished," Gutenson asserts. "If you look at the CEBus efforts from the standpoint of when they are likely to get product to market, we may well have a retrofit kit being sold by the time that happens."

Smart House and CEBus

Any conflicts between Smart House and CEBus must be seen as resulting from conflicts between the political and economic interests of the industry members of the National Association of Home Builders (NAHB) and the Electronics Industry Association (EIA). "In

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ways, both of them are oriented toward new products," Gary Arlen of Arlen Communications, a Washington-based consulting firm specializing in information age markets, points out. I guess you could argue that people buy appliances more often than they buy houses—but does that say one way or the other is the right way to go?"

The CEBus standards setting process is not an easy thing, one, because it's volunteer labor and, two, because it's a complex effort. "But I can see that if they have the stamina to persist at this, eventually they'll come out with something that will probably work," Baggett says. Baggett is certainly speaking from experience, having been involved with standards setting since early RS-232 efforts.

Gutenson of Smart House sees it differently. "Standards often are driven by market rather than by standards setting efforts. By getting to market first, getting the product out there and with some of the key manufacturers that we have on our side, we think those conditions will put Smart House in a good position to become the de facto standard."

Smart House's approach is to centrally manage market forces for the entire home automation enterprise, rather than leave it to the invisible hand of providence. "How do you go to your investors and say, 'Invest in this project but we don't know what the schedule is because we don't have any control over it.' So we had to do something that put us in charge of our destiny," Gutenson explains. "We are very much commercialization-driven," Gutenson continues. "That's why we do a lot of market research. Within a standards environment, you don't do that. You find a standard and then allow all the product manufacturers to do their own market research."

The strategic directions being taken are clearly apples and oranges. It is no wonder that Gutenson finds, "When we look for opportunities for cooperation we run into that sort of problem as well. Our goals and objectives are different."

A case in point, as Gutenson relates, was the last CEBus meeting which Smart House attended. "We actually put a proposal on the table at the last CEBus meeting where we said we would be willing to dedicate some amount of engineering time to work with CEBus to define a gateway to allow the two networks to coexist and find some level of interoperability. And the guys at CEBus said, 'That sounds like a business proposal, and this is a technical meeting and we're not allowed to do that kind of stuff.'"

At this point Smart House is willing to go it alone. "The most aggressive dates that I've seen [for the CEBus standard] were the end of this year. I am hardpressed to see how that can be accomplished," Gutenson questions. "But if it can, that's sixteen months after our protocol was frozen. What were we supposed to do for sixteen months? Our communications circuits are being reduced to applications specific integrated circuits. Our central controller is being reduced likewise. By the end of the year, those efforts will be complete. We will be transitioning to manufacturing next year."

Baggett sagely explains, "There's always a certain amount of initial posturing that must be done by the various industries involved. After that's done and after the people who really aren't interested in it [drop out], then it comes down to a group of people who are honestly and earnestly interested in fixing the problem. I think we are down to that stage with CEBus."

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come up with something that the phone company or the cable company or the power company can't live with, it's not going to fly. It makes their job harder, but you get practical, real world solutions this way."

Even Gutenson alludes to this. "Once things are defined and the standard exists, then it seems to me that is the time to start seriously talking about how you can bridge that gap and try to bring together some compatibility."

Home automation and cable TV

But where does all this leave cable television? Well, by some reports, it leaves cable TV somewhere outside trying to connect to a non-standard F-fitting and wondering if they will be hooking up to a system that might result in product liability suits. Says Baggett, "That creates a real problem because the concept of CEBus or Smart House is that any contractor could go in and install this in a house. Not all drop cable is UL approved. And then there is the FCC's signal leakage requirements." Back when Joe Van Loan was a consultant with Smart House, he recalls urging care. "I cautioned them that the communications plugs were tricky because we have had our share of trouble with the F-fitting."

"I don't think there's too much disagreement between cable and CEBus," reports Baggett, "as far as the specification of the components that go into the house. But the big thing that has to be solved is the cost of 'Node Zero' verses what channels do they use in-house for routing video." Node Zero is the designation for the CEBus controller.

"The original thing they said to us in cable was, 'Well, give us half a dozen channels somewhere up in the hyperband.'" Baggett says he informed them that "any channels we can use, we will use". Instead, he suggested, "Have your Node Zero notch out anything that's not being used at the moment and you can reuse those channels in the house—but you've got to notch it out so that it doesn't disturb anything on cable." But that could drive up the cost of Node Zero.

Also the requirement for channels has grown. It started out as two and went to six. Now it's twelve channels. "We said that's definitely out of the question,' Baggett relates.

Is the cable industry as a whole concerned about all this? "They aren't always fair to the outside world," says Van Loan, "because these standards setting bodies are out doing their thing and the cable industry tends to underparticipate in those activities. Then they don't always like what they get." However Van Loan adds, "Cable TV is an industry that runs lean by it's nature—and that's the secret to its success. By virtue of that they don't have time to spend at meetings pontificating on the future."

But others see an opportunity still existing for home automation functionality located in the cable converter box. "A lot of the smarts [may] fall back into that cable converter box," says Cogbill of Parks Associates. "That may be the key link to bringing in and supporting the videotex industry that has had a struggle so far."

General Instrument's Jerrold Division is closely watching these developments. Not only is Tom O'Brien of Jerrold the chairperson of the CXBus (coaxial) subcommittee at the EIA, but Jerrold currently has prototypes of a new intelligent converter box with a cordless telephone keypad with remote control interface.

According to Dan Moloney, Jerrold's

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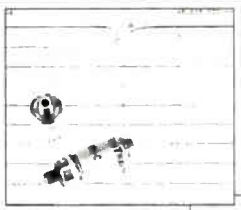
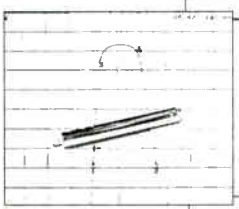
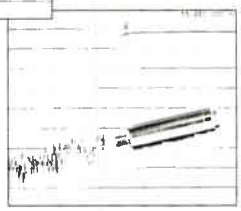


Negative traps channels 2-NN. Positive decoding traps ch. 2-13, (A-2)-I

Tiering filters for channel block suppression



Single premium channel bandpass



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director of product management, their Remote-N-Phone device has the capability of accessing the public telephone network, communicating via an impulse return module, data retrieval over cable and storage, and a TV screen display that provides menu-driven control. Excluding the converter itself, Jerrold sees the cost of the module and the remote at about $80 to $85.

Current prototypes can incorporate X-10 protocols, admittedly primitive, for control of other devices in an automated home. They are also awaiting the CEBus Interim Standard and envision its incorporation.

Jerrold has consultants looking at how this may fit in with Smart House but, according to Moloney, "We're personally not sure of the long term viability of the Smart House concept as it exists today."

In Cogbill's view, the local cable operator could offer a home automation channel. "On that TV set may be a channel that says, 'I am your Home Channel. What would you like to work with?'" Cogbill envisions the cable operator remotely locating automation control of the subscriber's home at the headend.

Gee wiz

Like with all high-tech goodies of the future, the reaction is 'gee wiz.' But is gee wiz an expression of enthusiasm or exasperation? "No one wants to have a confrontation with technology everyday,' says Van Loan. It's not that consumers are unintelligent or unsophisticated. The question, Van Loan suggests, is, "Are they willing to waste their time on the struggle?" Van Loan believes the interface needs to be a 'black box.'

Baggett has found agreement that the human interface is much too complicated than it needs to be. Last spring he visited Japanese manufacturers of consumer electronics and has talked to European manufacturers as well. "They all agree," Baggett reports, "there needs to be and there is going to be a trend over the next few years toward simplifying the interface."

According to Arlen, "This is absolutely vital. No matter how user-friendly designers try to make these things, if they still look high-tech and intimidating, in a mass market, people just won't use it."

Cogbill believes the majority of functions in the automated home will be set-and-forget but, "I think we will continue to be challenged by things that require operating and making choices on a real-time basis."

Will sophisticated in-home wiring and control systems mean every morning and every evening will see a man vs. technology confrontation? And will VCRs continue to blink 12:00 across America—despite this available technical sophistication? "Boy, I sure hope not," says Gutenson at Smart House. "There has to be in the system a level at which it will operate and provide new features and benefits to the consumer with very little interaction required," Gutenson offers. "Initially, there will be additional layers of functionality that I expect will require additional knowledge to be able to interact with. And as time passes I expect that two things will happen to lower that threshold. One, consumers will become smarter. The second thing is that we as designers of the product will get smarter about how to make interaction easier. The old blinking VCR problem, in home automation, ought to go away. Because in our system the central controller, once a day, just broadcasts the time to all the things connected to the system. After a power outage, any device that has a display can ask the controller, 'What time is it?'"

What time is it?

At least since World War II we have seen magazines like Popular Science with these "home of the future" articles—but do they ever go anywhere? Arlen believes they go very far. "One of the problems of all of us who read those kinds of magazines is the perception that we get from here to there in the blink of the eye.'

The Radio Shack components, the X-10 devices, Smart House, CEBus and the gee wiz popular press articles are all part of an evolutionary process. "All of these are contributing factors that get to the home of the future," says Arlen. "And that home of the future that Popular Science or any of the magazines have shown off over the years is a bunch of products that wind up being integrated in some way, shape or form."

However, Arlen looks two generations out before he sees home automation on a significant scale. Smart House projects five years. "We are going to start selling systems next April and we are going to sell them as rapidly as we can," says Gutenson. "We would like to believe that will have some impact in the market immediately." ■

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AM fiber links: performance limits and reliability

There has been much discussion on where the ultimate signal quality limitations will occur for transmission of multiple AM-VSB television signals over fiber. Recently, a more precise understanding of the physical phenomena which limit transmission quality has been achieved. Fundamental limits established by shot noise, clipping, fiber impairments and laser resonance distortion all combine to limit link performance to the level of about 55 dB CNR and 65 dB composite distortion.

Much attention has been given to the analog reliability of lasers and laser modules. In particular, concerns have been raised as to the stability of the noise and distortion of the link over time. These concerns have been addressed through detailed aging studies on more than 100 devices drawn from our analog-specific production line. Chips and modules have been subjected to high stress (100 degrees C) and long term (60 degrees C) aging, as well as thermal cycling (-40 to 85 degrees C). These tests show negligible changes in noise and distortion in both RIN and multi-channel tests. We conservatively estimate a median lifetime of more than 25 years.

The application of lightwave transmission technology to CATV trunking applications was first discussed by J.A. Chiddix more than 3 years ago.[1] Essentially, an evolutionary solution was required, in which the existing transmission plant would be transparent to the gradual introduction of fiber. These and other constraints excluded the existing FM supertrunking technology, and also the embryonic digital options. AM transmission was found to be the only viable alternative.

Chiddix described a set of signal quality objectives which would result in negligible impairments in the trunking plant. The signal quality of the link is commonly expressed in terms of four quantities: carrier-to-noise ratio (CNR), composite second order distortion (CSO), composite triple beat (CTB), and cross-modulation (XMOD). The behavior of links with respect to these parameters has been described in numerous other papers.[2,3,4,5,6]

It emerges that in actual experience

By J. Lipson, MTS, C.B. Roxlo, MTS, C.J. McGrath, MTS, AT&T Bell Laboratories

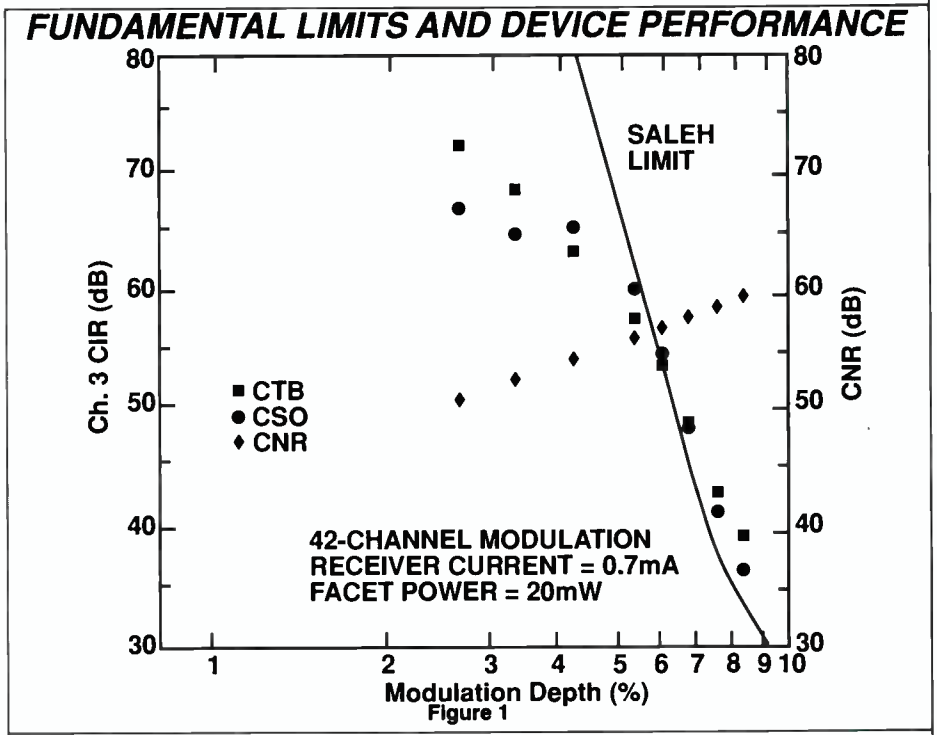

Figure 1

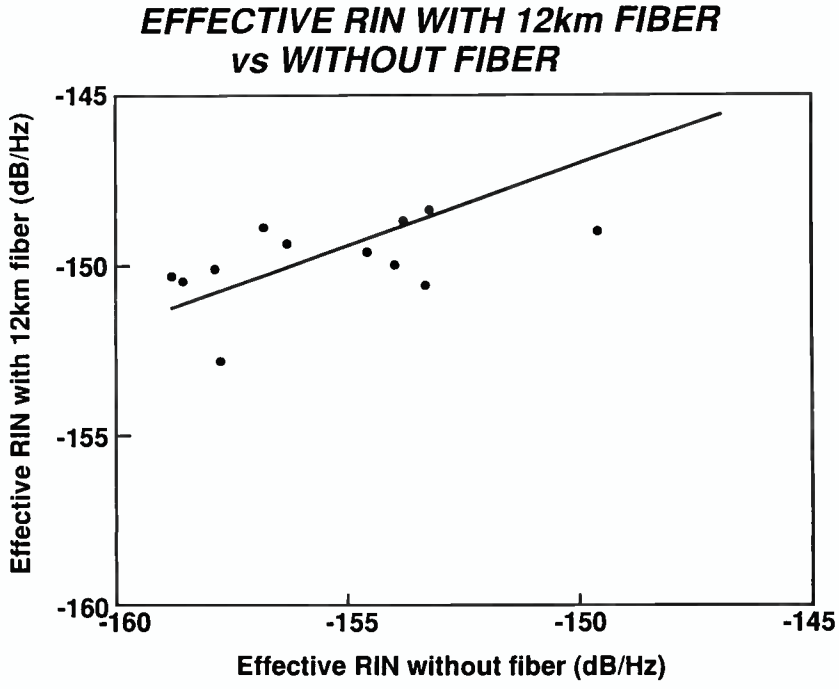

Figure 2

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with live video signals on lightwave links, XMOD is negligible, consequently, it will be omitted in subsequent discussion. One of the purposes of this article is to describe the performance of state-of-the-art AM trunks with respect to fundamental limits. Initial desires for 42 channel links with CNR > 55 dB, CSO > 65 dBc, and CTB > 65 dBc with loss budgets > 10 dB are close to the edge of what is possible.

Practical control of critical processes may restrict commercial applications to a few dBs below the ideal levels, yet, lightwave links will play a critical role in upgrading existing CATV systems. J.A. Mattson recently demonstrated that the total CSO of the system is insensitive to trunk signal quality in the regime CSO > 55 dB. This validates the assertion that the ultimate performance is not necessarily required in the context of other system degradations. With many hundreds of lightwave trunks in the field, numerous system operators have been able to verify the beneficial results.

Also in this paper we shall discuss four fundamental limits which give rise to irreducible impairments in link performance:

- Statistical clipping during excursions of the signal which drive the laser below threshold.[8,9]
- Excess distortion at high frequencies caused by the proximity of the relaxation oscillation resonance in the laser.[10,11]
- Multi-path interference effects caused by Rayleigh scattering in the fiber.[12]
- Shot noise.

Finally, we discuss new results concerning the reliability of the critical components. We show that a median time to failure of >25 years can be expected. Some brief conclusions concerning the direction of the technology are then given.

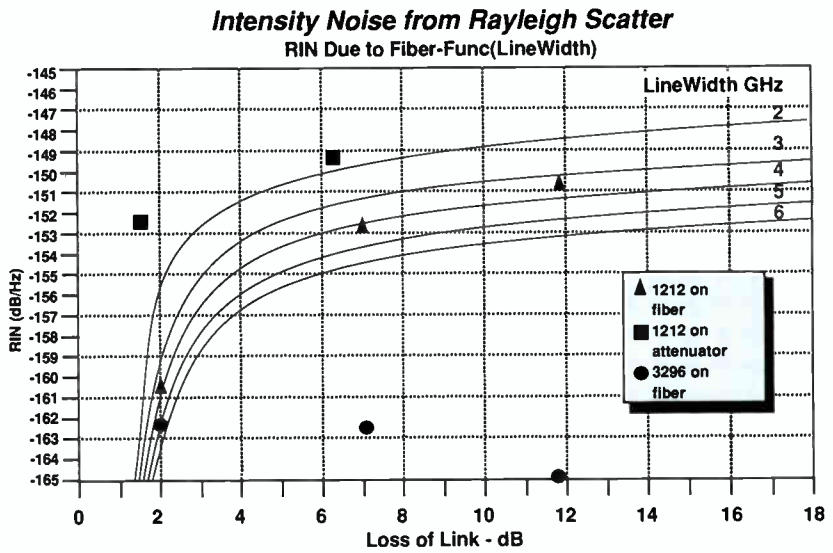

Figure 3

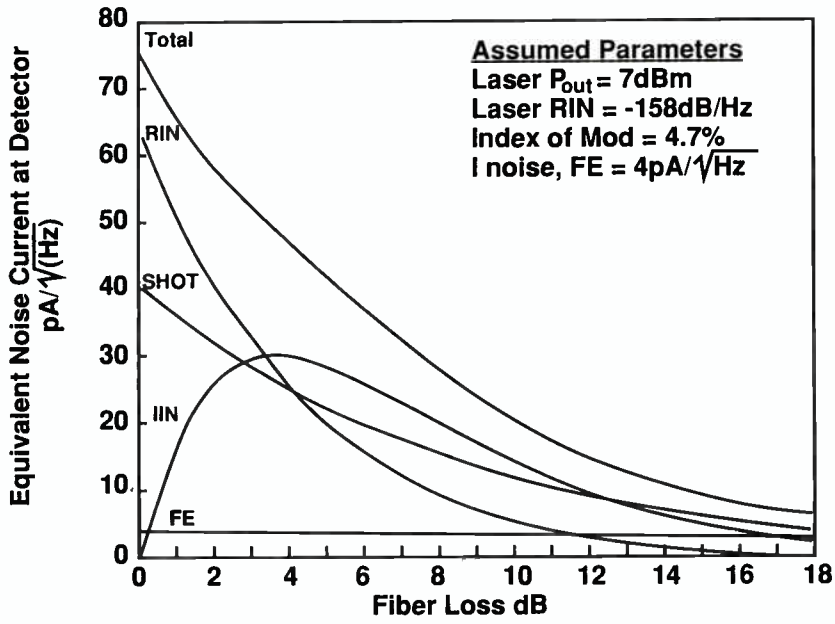

Figure 4

Statistical clipping

Because the product of the number of channels and the modulation index per channel generally exceeds unity, the net modulating waveform will, at times, drive the laser below threshold. Since the laser turns off abruptly for drive currents less than the threshold current, this clipping can be expected to give rise to distortion. The total distortion that may be expected to appear, in all orders, in an individual channel has been calculated using Gaussian signal statistics[8,9] (the second reference contains a refinement of the original analysis).

In Figure 1 we show the total carrier to interference ratio (CIR) (interference being the total power in all orders of distortion) versus the modulation depth per channel for a 42-channel system. Data from a laser operating at 20 mW facet power is shown along with the analytical curve. It can be seen that as the modulation index increases, the CNR continues to increase (as the square), but that both CSO and CTB degrade catastrophically as the limit is approached.

It should be emphasized that the Saleh limit is not applicable, per se, to any particular order of distortion but rather the sum of all orders. Consequently, CSO and/or CTB may occasionally lie to the right of the analytical curve. Nevertheless, clipping limits the modulation index that can be usefully employed.

The coupling between the photons and the injected carriers in semiconductor lasers gives rise to a resonance phenomenon which causes the distortion of the laser to become a function of the frequency.[10,11] The distortion is worse at high frequencies scaling as

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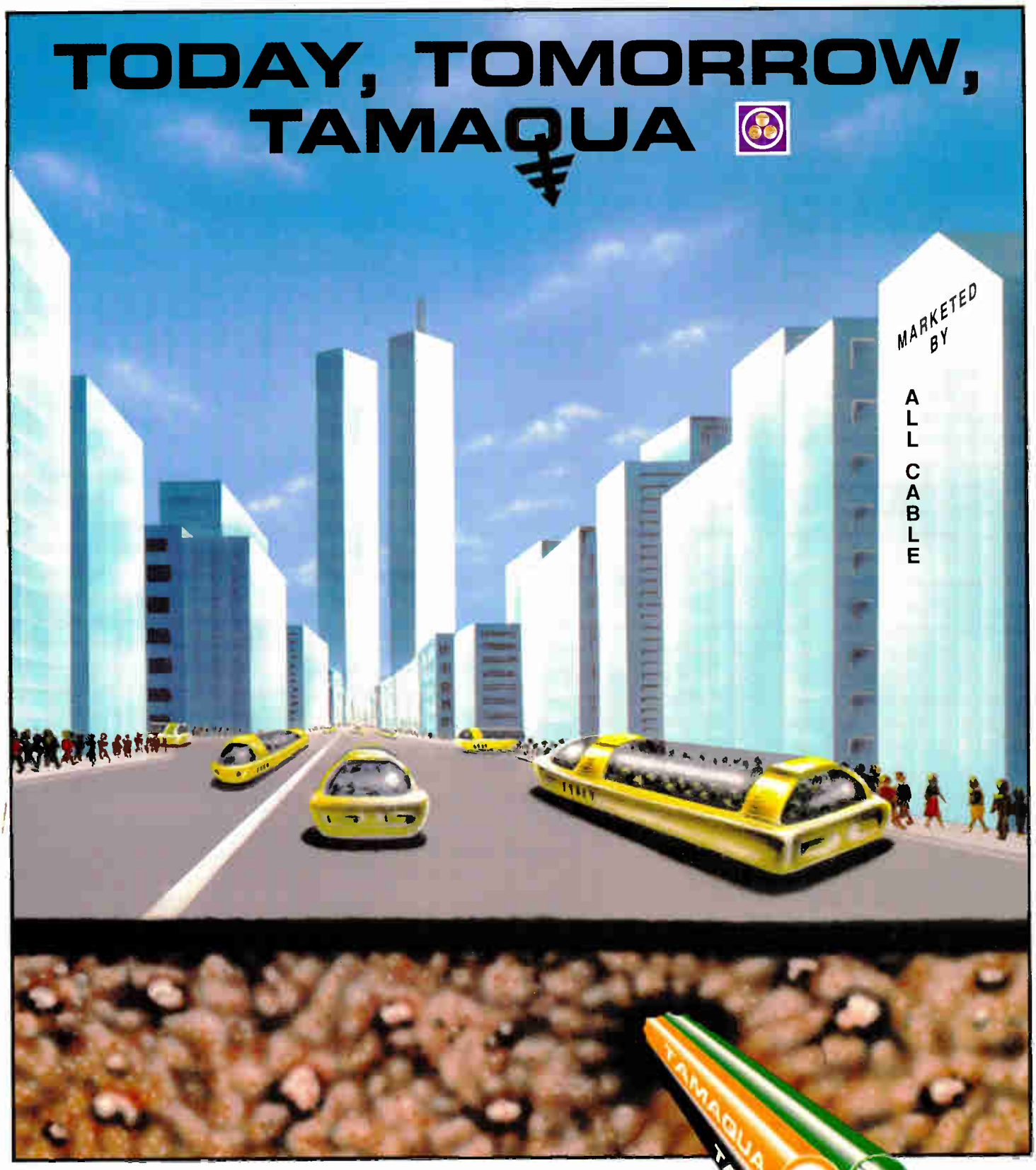

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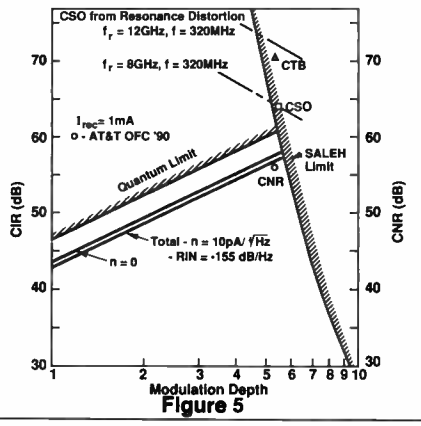

Figure 5

$(f/f_r)^4$, where f is the frequency of the intermodulation product and f_r is the relaxation resonance frequency of the laser. For f = 320 MHz, f_r = 8-12 GHz, a modulation index of 0.05/channel, and a 42-channel load we can expect a CSO of from 65 to 72 dBc. In general, this effect may limit the second order distortion for lasers whose basic linearity is very good (the effect on CTB is less dramatic). Because of the steep scaling with frequency, resonance distortion may limit the number of channels that can be placed on any one laser.

Contributions to noise

The expression related to carrier-to-noise ratio is given in Equation 1.

$$CNR = \frac{(I_0 m)^2}{2B\left[n_r^2 + 2qI_0 + I_0^2\left[RIN - \frac{2qn}{I_0}\right] + RIN_{sys} I_0^2\right]} \quad (1)$$

n_r = preamplifier noise

I_0 = received current

n = coupling efficiency between laser and detector

B = channel noise bandwidth

RIN_{sys} = noise due to system impairments

RIN = laser relative intensity noise

q = eletronic charge

m = modulation index per channel

Let us consider each of the noise terms in the denominator in order to understand their relative magnitude.

Receiver noise. The first term comes from preamplifier noise and is typically of the order of 4-5 pA/(Hz)$^{1/2}$ for a state-of-the-art analog receiver. It will be seen later that this is generally negligible compared with the other sources of noise.

The next term is shot noise, which represents the irreducible quantum mechanical fluctuations in electron flow present in any received signal.

Laser noise. The third term accounts for noise produced by the laser. The term involving n is often neglected and is inherent in the original definition of RIN.[13]

System impairments. The fourth term describes any contributions to noise due to system impairments. It has been found that the presence of a significant amount of fiber in the system gives rise to a noise penalty. In Figure 2, we show the effective relative intensity noise of a number of lasers with, and without the presence of 12 km of fiber. The effective RIN is obtained by measuring the carrier-to-noise ratio. Both the receiver front end noise and the shot noise are known, consequently, the sum of the laser noise and the system impairment noise can be derived from equation 1. This sum is defined as the effective RIN.

It can be seen from Figure 2 that without fiber, RINs are typically in the range of -155 dB/Hz to -160 dB/Hz, whereas, in the presence of 12 km of fiber, there appears to be a noise floor at about -150 dB/Hz. It is theorized that this excess noise contribution is due to multiple Rayleigh backscattering in the fiber.[12] Essentially, the main signal beam interferes with multiple scattered beams that also impinge on the detector. This interference converts laser phase noise to intensity noise.

In Figure 3 we show the predicted RIN contribution from this phenomenon for various dynamic laser linewidths. Data taken from two laser modules are also presented. During modulation the effective index of the laser cavity is changed due to variations in carrier density. In consequence, the center wavelength of the laser shifts dynamically. When a large number of independent modulating signals are present, the linewidth is expected to have a Gaussian shape.[3] The theory actually predicts a larger noise penalty for smaller linewidths. This is because smaller linewidths imply greater coherence and a larger contribution due to interference. It can be seen that package 1212 shows noise penalties which increase predictably as a function of fiber loss, but when the identical loss is introduced by a passive attenuator, there is no penalty.

Summary of noise sources. The relative contribution of each source of noise is summarized in Figure 4. All noise sources are described by an equivalent input current noise to the receiver. For the assumptions given in the Figure, the largest contribution of the noise is interferometric interference (IIN) for fiber loss >5 dB. Shot noise and RIN are non-negligible but front end noise from the receiver tends to be small in comparison.

Summary of fundamental limits. The relationship between all the fundamental limits and the performance of a state-of-the-art link is summarized in Figure 5. First, let us consider noise. The circular data point shows a carrier-to-noise ratio of 55 dB. The data point lies close to lines which define noise contributions for receiver noise of 0 and 10 pA/(Hz)$^{1/2}$ respectively, and for a laser RIN of -155 dB/Hz. As has been previously discussed, the effective RIN of most links is actually in the order of -150 dB/Hz. One can see that the actual result is very close to realistic limits.

The CSO and CTB (triangular and square data points) are also shown. Both data points lie reasonably close to the Saleh limit. In addition, the CSO lies on a limit predicted for resonance distortion for a resonance frequency of 8 GHz and for a carrier frequency of 320 MHz. The general conclusion is that a state-of-the-art link operates very close to several fundamental per-

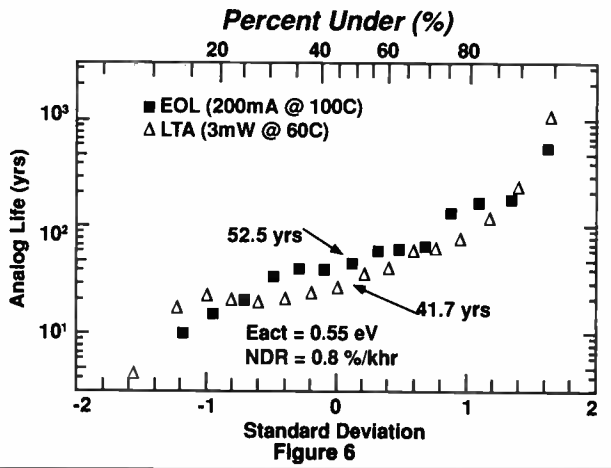

Figure 6

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formance limits, and cannot be substantially improved except by increasing laser power.

Reliability

Chip aging. The use of long wavelength semiconductor lasers in long-haul telephony applications, both terrestrial and submarine, has resulted in a large data base on the reliability of these lasers in digital applications. This work has shown that laser degradation is gradual, consisting primarily of slow increases in threshold. Median degradation rates of less than 1 percent/kHr at 60 degrees C and 0.06 percent/kHr at 20 degrees C are well documented. However, such work has done little to directly address the concerns of those using an analog laser system. Foremost among these are the changes in laser noise and distortion introduced by long term aging.

To measure these effects, we have aged more than 100 laser chips and modules selected from our analog laser production, under a variety of conditions. Chips were aged under two types of stress. High stress aging at 100 degrees C and 200 mA bias current, allows the engineer to age the laser to the end of its useful life within a few hundred hours. Long-term aging, at 60 degrees C and 3 mW output power, is the closest we can get to actual use conditions while still observing a noticeable degradation rate.

The results are summarized in Figure 6 where the expected analog lifetime is shown for populations of chips subjected to end of life aging (EOL) and to long term aging (LTA). Mean lifetimes of greater than 40 years are expected with respect to increases in second order distortion. In addition, no measurable change of RIN occurred for these populations.

Temperature cycling of laser modules. The coupling between the laser and fiber in a laser module can change substantially due to submicron motion. This can lead to changes in both coupled power and distortion. The most severe test to determine if a package is mechanically stable is large excursion temperature cycling. We cycled six devices 100 times from -10 to 65 degrees C, and 100 times from -40 to 85 degrees C. We measured the CSO and the CTB both before and after cycling. A normal probability distribution for the change in CSO and CTB is shown in Figure 7. Within the measurement limits of the experiment we were unable to observe any change in distortion.

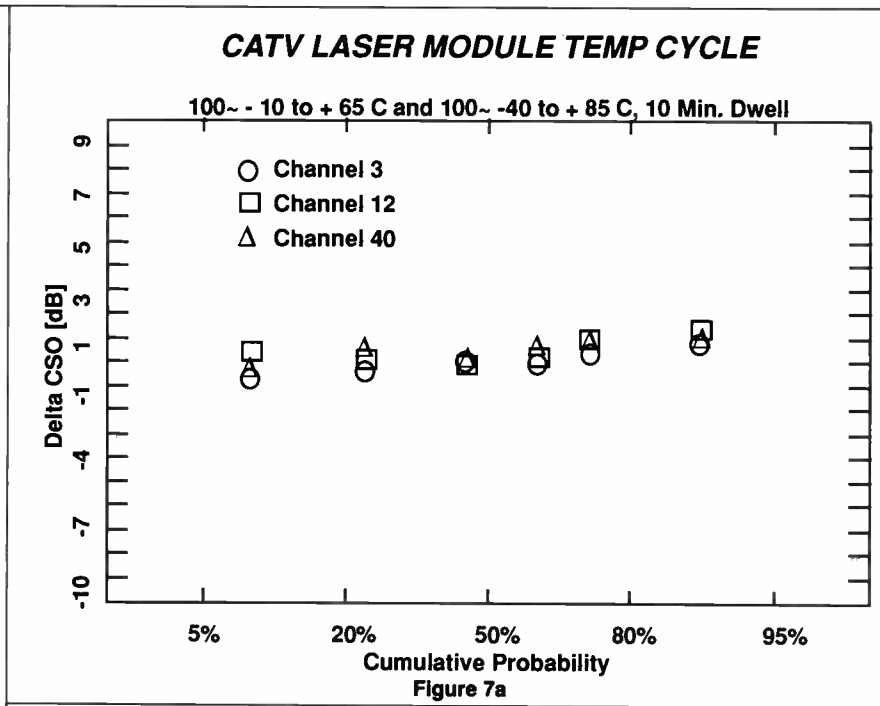

Figure 7a

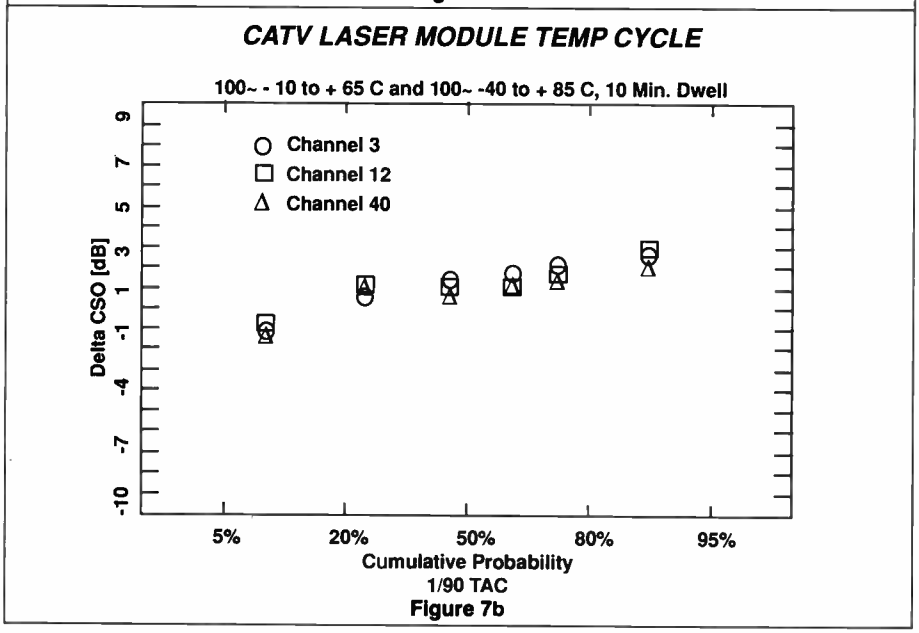

Figure 7b

Conclusions

State-of-the-art analog links are not limited in performance by the basic linearity of the laser but by clipping, resonance distortion, shot noise and multi-path interference effects. The basic technology can only achieve an evolutionary improvement through increased laser output power. Over a longer time frame fiber optical amplifiers[14,15,16] may become important. A carrier-to-noise ratio of >50 dB with a loss budget of >20 dB, with CSO and CTB >59 and 60 dB respectively was recently demonstrated,[16] but effects of fiber dispersion at 1.55 microns, and enhanced noise from the amplifier need to be considered carefully. It is likely that the laser technology has reached something of a watershed with respect to performance. In this context, numerous systems continue to be deployed and we have demonstrated that the end-user can expect to enjoy not only improved system performance but greatly enhanced reliability. ■

References

1. J.A. Chiddix, "Optical Fiber Super-Trunking, The Time has Come, A

Performance Report on a Real World System," IEEE. Journal on Selected Areas in Communications., SAC-4, no. 5, August 1986.

2. J. Lipson, L.C. Upadhyayula, S.Y. Huang C.B. Roxlo, E.J. Flynn, P.M. Nitzche, C.J. McGrath, G.L. Fenderson, and M.S. Schaefer, "High Fidelity Lightwave Transmission of Multiple AM-VSB Signals," IEEE Trans. on Microwave Theory and Techniques, Special Issue on Applications of Lightwave Technology to Microwave Devices, Circuits, and Systems, MTT-38, 483 (1990).

3. T.E. Darcie, and G.E. Bodeep, "Lightwave Subcarrier CATV Transmission Systems," same as in Ref. 2, p. 524 (1990).

4. T.E. Darcie, J. Lipson, C.B. Roxlo, and C.J. McGrath, "Fiber Optic Device Technology for Broadband Analog Video Systems," IEEE LCS, Vol. 1, No. 1, p. 46 (1990).

5. L.C. Upadhyayula, J. Lipson, and S.Y. Huang, "Trunk Quality Lightwave Transmission of Multiple AM-VSB NTSC Signals," in "Technical Digest of the Conference on Optical Fiber Communications," (IEEE/OSA, San Francisco, 1990), paper WH3.

6. K. Fujito, T. Uno, T. Ichida, and S. Serizawa, "Low Noise Wideband Analog Optical Link Using a DFB Laser Diode," in "Technical Digest of the Conference on Optical Fiber Communications," (IEEE/OSA, New Orleans, 1988), paper THO1.

7. J.A. Mattson, "Specifying AM Fiber System Performance," in "NCTA Technical Papers," (NCTA, Atlanta, 1990), p. 181.

8. A.A.M. Saleh, "Fundamental Limit On Number of Channels in Subcarrier Multiplexed Lightwave CATV Systems," Elec. Letts., 25, 776 (1989).

9. T.E. Darcie, "Subcarrier Multiplexing for Lightwave Networks and Video Distribution Systems," IEEE Journ. Sel. Areas of Comm., Sept., 1990, to be published.

10. T.E. Darcie, R.S. Tucker, and G.J. Sullivan, "Intermodulation and Harmonic Distortion in InGaAsP Lasers, Elec. Letts., 21, 665 (1985); erratum Vol. 22, 619 (1986).

11. K.Y. Lau, and A. Yariv, "Intermodulation Distortion in a Directly Modulated Semiconductor Injection Laser," Appl. Phys. Letts., 43, 1034 (1984).

12. A.F. Judy, "Intensity Noise from Fiber Rayleigh Backscatter and Mechanical Splices," presented at 15th European Conference Opt. Commun. (ECOC '89), Gothenburg, Sweden, Sept. 10, 1989.

13. Y. Yamamoto, "AM and FM Quantum Noise in Semiconductor Lasers - Part 1: Theoretical Analysis," IEEE J. Quant. Elec., QE-19, 34 (1983).

14. W.I. Way, M.M. Choy, A. Yi-Yan, M. Andrejco, M. Saifi, and Chinlon Lin, "Multi-Channel AM-VSB Television Signal Transmission using an Erbium-Doped Optical Fiber Power Amplifier," in "Technical Digest of IOOC '89," (IOOC, Tokyo), paper 20PDA-10.

15. K. Kikushima, E. Yoneda, and K. Aoyama, "6 Stage Cascade Erbium Fiber Amplifiers for Analog AM and FM-FDM Video Distribution Systems," in "Post Deadline Papers of the Conference on Optical Fiber Communications," (IEEE/OSA, San Francisco, paper PD22.

16. S.Y. Huang, T.W. Cline, L.C. Upadhyayula, R.E. Tench, J.R. Simpson, and J. Lipson, "Point-to-Multipoint Distribution of 42 Channel VSB-AM Video Signals using an Erbium-Doped Fiber Amplifier," in "LEOS Summer Topical Conf. On Broadband Analog Optoelectronics, Devices, and Systems," (LEOS, Monterey, 1990), paper BAM7.

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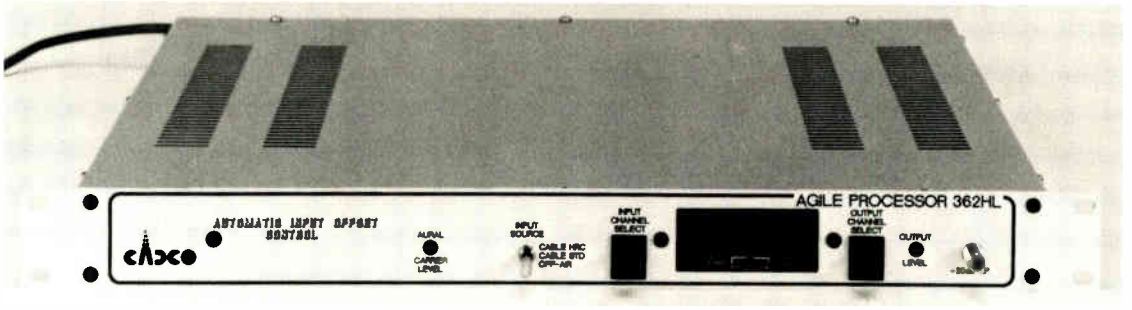

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WHAT'S AHEAD

SCTE

Following is a list of SCTE technical seminars with contact name. If known, location and seminar topic are listed.

November 7 *Rocky Mountain Chapter* "Data" and "Terminal Devices." Location to be announced. Contact Rikki Lee, (303) 321-7551.

November 8 *New England Chapter, Upper Valley Meeting Area* "Cable Handling and Preparation" with Bob Glass of Comm-Scope and "LRC and QR Fittings" with Jim Miller of dB Communications. Contact Matthew Alldredge, (802) 885-9317.

November 8 *Big Country Chapter* Abilene, Texas. Contact Al Scarborough, (915) 698-3585.

November 10 *Chaparral Chapter* "BCT/E Category III Tutorial—Transportation Systems with Ron Hranac of Coaxial International. To be held in Albequerque, N.M. Contact Brian Throop, (505) 761-6200.

November 10 *Upstate New York Chapter* Adelphia International offices, Buffalo, N.Y. BCT/E examinations to be administered (tenative). Contact Ed Pickett, (716) 325-1111.

November 11-12 *Old Dominion Chapter* Annual meeting/officer election. Additional topics to be announced. Holiday Inn, Richmond, Va. Contact Margaret Davison-Harvey, (703) 248-3400.

November 13 *Central Illinois Chapter* "New Technologies." To be held at the Sheraton Normal Hotel, Normal, Ill. Contact Ralph Duff, (217) 424-8478.

November 13 *Florida Chapter, South Florida Meeting Area* Contact Rick Scheller, (305) 753-0100.

November 13 *Great Plains Chapter* Contact Jennifer Hays, (402) 333-6484.

November 14 *Appalachian Mid-Atlantic Chapter* "Microwave Transportation Systems," Holiday Inn, Chambersburg, Pa. Contact Dick Ginter, (814) 672-5393.

November 14 *Dixie Chapter* Birmingham, Ala. Contact Rickey Luke, (205) 277-4455.

November 14 *Greater Chicago Chapter* "BCT/E Category V—Data Networking and Architecture." Contact John Grothendick, (800) 544-5368.

November 14 *North Country Chapter* "Fiber Optics" and "Feedforward." To be held at the Sheraton Midway, St. Paul, Minn. Contact Rich Henkemeyer (612) 522-5200.

MAGNAVOX CATV SYSTEMS, INC.

The Magnavox CATV Systems mobile training center is a fully-equipped laboratory on wheels for CATV, fiber optic and LAN training. The three-day seminars combine instruction in theory and practical hands-on training. The fee is $350. Call Amy Costello Haube at (800) 448-5171 (in N.Y., (800) 522-7464) for information and reservations.

November 6-8
Boston, Mass.
November 13-15
Boston, Mass.
November 19-21
Syracuse, NY

Scientific Atlanta

Scientific-Atlanta offers technical training for subscriber products as well as advanced training for the industry. The following seminars will be held at the Minneapolis Marriott Hotel in Bloomington, Minn. Contact Sylvia Rogers, (800) 722-2009 (press 1, then 2).

November 6, December 4 Headend and Earth Systems Training

November 7, December 5 Distribution Systems Training

November 8, December 6 Fiber Optic Systems Training

FC²

Fiberoptic Communications Corp.,a certified training facility for GTE, Anritsu and Ametek Controls, is offering 5-day fiber optic splicing and termination workshops at its Sturbridge, Mass. facility. The course is college accredited, and available on the following dates:

November 12-16
December 10-14
January 14-18

For further details, call (800) 776-0518.

SIECOR

Siecor Corp. will sponsor fiber optic training programs designed to eet the needs of installers and users of fiber optic products. Following are dates for the program "Fiber Optic Installation and Splicing for Outside Plant Applications." For more information on classes, pricing and registration call (800) 634-9064.

December 3-6

Trade Shows

Western Show
November 28-30 Anaheim, Calif. Contact Trade Associates Inc., (301) 468-3210

SCTE Fiber Optics 1991
January 8-10 Hyatt Regency Grand Cypress, Orlando, Fla. Contact the SCTE National Headquarters at (215) 363-6888.

Eastern Show dismal; Atlantic draws well

After suffering through a relocated Eastern Show that was described as nothing short of dismal by most vendors, suppliers generally gave Atlantic City's Atlantic Cable Show thumbs up for its attendance figures, in spite of a dry hardware market (see related story, page 30). According to Atlantic Show officials, attendance this year was pegged at nearly 3,800 persons, off by just 200 attendees compared to last year. However, most vendors expressed satisfaction with traffic levels and quality of attendees.

However, little news emanated from the convention hall floor (with the exception of a few new products being shown), reinforcing the notion that many new products will debut at the Western Show in late November. Instead, most conversations among hardware suppliers focused on attempts to explain the industry's economic downturn and predictions of when it would return to healthy levels.

Despite the foreboding atmosphere of expected legislation and warnings of tight credit availability, operators attending the show only confused the issue by professing a business-as-usual modus operandi for 1991, according to exhibitors.

Any and all action in Atlantic City was welcomed with open arms by exhibitors who attended the Eastern Show in Washington, D.C. the prior week. That show reportedly featured empty aisles and little activity. In fact, exhibitors voted to close the show earlier than previously announced.

But Eastern Show organizers expressed general satisfaction with the show, according to published reports, because it gave legislators an opportunity to hear from cable-industry leaders regarding pending regulation (which was apparently killed two weeks later on the Senate floor).

Many exhibiting companies were upset over the timing of the Eastern, Great Lakes and Atlantic shows. The Eastern and Great Lakes events were held during the same week, followed the following week by the Atlantic Show, which conflicted with the Walter Kaitz event in New York. The scheduling problems shouldn't exist next year, however; the Eastern Show is set for August 25-27 and returns to Atlanta, the Great Lakes will be in Detroit September 24-26 and the Atlantic Show stays in Atlantic City October 1-3.

New products

Power Guard showed off its line of surge protected power inserters. The "Power Clamp" series is available in several kits designed to retrofit existing power inserters from Antronix, General Instrument, Magnavox, Regal and Scientific-Atlanta. The circuit is also available for plug-in installation in Power Guard power supplies, according to company officials.

Meanwhile, **Lectro** introduced a new power supply and a line of meter base products for use with Lectro standby and non-standby power supplies. The new Uni-Max standby power supply features plug-in modules and is rated at 91 percent efficiency, according to Lectro executives. The meter base product, which is designed to incorporate a power supply and a utility meter in the same housing, is available in a variety of sizes to accommodate local needs.

Program Info Corp exhibited its new Cable TeleGuide, an electronic program guide designed in conjunction with Century Communications of Hartsville, S.C. The system previews upcoming program information on the lower two-thirds of the screen in a grid format, similar to newspaper style. "Our independent research revealed that people prefer the grid format," says Tom Russell, president. "Scrolling logs were found to be too hard to follow."

The system, designed to be "user-friendly" and in a modular format, receives local programming via telephone modem on a weekly basis, with updated program changes downloaded as they occur. The system displays four channels and two hours worth of television programming per screen, with programming types distinguishable by color—movies displayed in blue, sports in green, news in gold and specials in light blue.

"The computer that drives the system is provided for the operator," Russell continued. "All the cable operator has to have is a dedicated telephone line and a modulator. There is no fee for the equipment." The five systems currently using Cable TeleGuide pay on a per-sub basis. Advertisements for upcoming programs run on the top third of the channel, with 12 minutes per hour available for local advertising. For more information, contact Program Info Corp. at (717) 233-0121.

Three announcements were made by **Digital Planet**, a provider of digital audio programming for cable television. In the first announcement, Digital Planet announced its selection of Communications Equity Associates, Inc. as the company's investment banker. In the agreement, CEA will represent Digital Planet in formalizing strategic alliances with cable industry investors, domestically and overseas.

Digital Planet also announced its rollout to three test systems including Continental Cablevision of Westchester, Calif., in early September. In the test systems, the service provides 24 hour service of 26 digital channels—15 of commercial free music, five cable simulcast channels such as HBO, TMC, Showtime, MTV and VH-1 and five niche premier programming sources, including Piccadilly radio of England. The full national roll-out will commence during the first quarter of 1991, with a projected 91 channels of digital audio programming.

Digital Planet's last announcement was an $85 million agreement with Matsui-Comtek, where Matsui-Comtek will provide the financing to cover the manufacture of Digital Planet's Hitachi-built tuners. "Matsui-Comtek is acting as an agent on sourcing our products internationally," says William DeLaney, president.

According to company officials, Digital Planet's adaptive equalization technology allows cable operators to deliver the company's signal in frequency rolloff areas, which doesn't strain available video frequency space. Also, Digital Planet's proprietary bit error correction technique is currently in patent processes. For more information on Digital Planet's services, call (213) 513-1630.

Other show announcements

In addition to new products, the Atlantic Show hosted announcements by two fiber optic vendors that prove fiber is being embraced by CATV. First, **Cablevision Industries** has purchased an all-AM fiber system from **Sumitomo Electric Fiber Optics Corp.** for the MSO's Hillsborough, North Carolina system rebuild.

The architecture is fiber to the line extender, which eliminates costly RF trunk amplifiers. The Hillsborough system, if it had chosen to stay with conventional RF electronics, would have had an amp cascade of up to 46 devices.

However, with fiber, no more than five active components exist between the headend and any subscriber.

Signals will be transported from the headend in Carrboro to an optical receiver node, then to six secondary optical receiver nodes, where the signals are converted to RF and transported via coax to each home. The key feature of the system is Sumitomo's optical strand-mount repeater, which receives, boosts and then re-transmits optical signals.

Fiber to the line extender is a new architecture that is apparently gaining momentum and has achieved cost equality with traditional RF/coax technology.

Texscan Corp. has tapped a lucrative market by receiving two major contracts to supply fiber optic systems to the United Kingdom's Department of Transport. The $2.3 million deal, inked by Texscan's European Op-Tech division, calls for a broadband transmission network with a fiber backbone to carry closed-circuit TV, data and audio circuits back to main control rooms in order to supervise traffic flow along motorways around Birmingham, England. A passenger alarm system for the Manchester Metro Link Project was also part of the agreement.

Texscan's Op-Tech division had previously supplied for major fiber systems to other motorways.

SCTE changes committee structure

At a recent meeting in Reno, the SCTE Board of Directors approved the creation of five committees to oversee and guide the existing 24 SCTE subcommittees. The five main committees are as follows:

Operations—Jack Trower, Wehco Video, chairman.

Finance—Les Read, Sammons Communications, chairman.

Planning—Bob Luff, Jones Intercable, and Bill Kohrt, Kohrt Communications, chairmen.

Training—Walt Ciciora, American Television and Communications, chairman.

Engineering—Tom Elliot, CableLabs Inc., chairman.

The committees will facilitate the consistent flow of information through regular reporting to the board. It is currently being determined which subcommittees will operate under which of the five committees, in accordance with the system.

Also, the SCTE has announced its call for papers and workshops for the 1991 Cable-Tec Expo, to be held June 13-16, 1991 in Reno, Nev. Technical papers that are accepted will be presented at the Society's 15th Annual Engineering Conference on June 13, 1991. Proposals for workshops are also being solicited. Expo workshops are "hands-on" sessions that will provide attendees with in-depth instruction on technical procedures that are used in day-to-day operations.

Submissions should include a brief abstract of the proposed paper or workshop, and should be sent to Bill Riker, Society of Cable Television Engineers, Inc., 669 Exton Commons, Exton, PA 19341—**no later than December 1, 1990.** For further information, contact the SCTE national headquarters at (215) 363-6888.

More papers needed

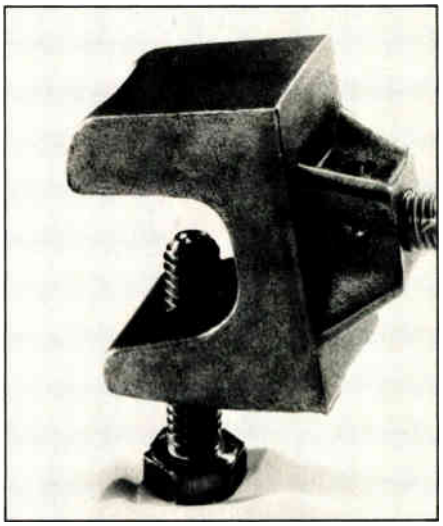
A call for technical papers has been announced by the **Consumer Electronics Society of the IEEE.** Papers are being solicited for topics in all areas of consumer electronics, including video, home information systems, design and manufacturing, audio, emerging technologies and components. The papers will be presented at the 10th annual International Conference on Consumer Electronics, scheduled for June 5-7, 1991, at the Westin Hotel O'Hare in Rosemont, Ill.

Authors are requested to submit ten copies of a 500-700 word summary and a brief (35-word) abstract for paper selection purposes by **January 16, 1991.** The deadline for digest material is **March 15, 1991.** For more information, contact Diane Williams, conference coordinator, at (716) 392-4397.

Product news

American Electric has announced a new UL listed beam grounding clamp designed to ground CATV pedestals and cable trays. The clamp is designed to with ground wire hole access from four different directions, which minimizes the need to bend the ground wire. A high strength anchoring bolt penetrates both paint and rust to minimize prior surface preparation. The clamp connects #6 to #14 solid copper conductors to metal framing.

Other advantages of American Electric's beam grounding clamp include a 7/16 inch silicon bronze hex head bold which installs with a cam-wrench, socket or crescent wrench; a non-plated copper alloy casting for better conductivity and corrosion resistant characteristics. Installation time is minimized by the design of the clamp, which allows the ground wire to be installed on the clamp prior to mounting it on the metal frame. For more information call American Electric at (901) 682-7766.



American Electronic's beam grounding clamp

Amphenol Corp. has announced a single mode in-line variable attenuator that provides continuously variable attenuation of 1300 nm and 1550 nm signals with greater than -45 dB return loss. Both in-line and panel mount installations are available. The attenuator has 0.2 dB resolution, insertion loss of less than 2 dB and attenuation range from zero to 40 dB. The pigtailed attenuators exhibit a bi-directional return loss of -45 dB over both the 1300 nm and 1550 nm operating windows. Applications for the attenuators include telecommunications, local area networks and CATV AM modulated optical fiber systems in which signal attenuation is required without increasing overall system return loss performance. The package is 1.17 inches long and 0.75 inches in diameter. For more information, Amphenol Corp. can be reached at (708) 960-1010.

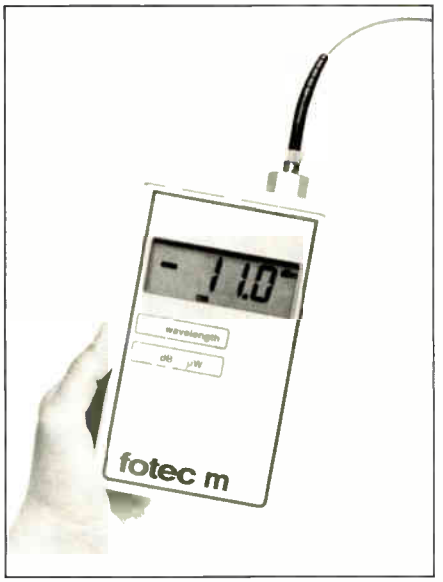
Amphenol's single mode in-line variable attenuator

AM Communication's LANguard

AM Communications has announced production of its new LANguard transponder, the TMC-8063, designed to be used within the **Lectro** standby power supply cabinet. The TMC-8063 provides continuous monitoring of critical power supply functions, including battery voltage, AC output voltage, AC output current and standby power status. According to AM Communications officials, when the power unit switches to battery backup, the LANguard software will sound an alarm so that an auxiliary power unit can be dispatched to the site. This lessens the occurance of outages caused by run-down batteries.

Additionally, power supply batteries can be tested remotely without disruption to normal system performance. For more information, contact AM Communications at (215) 536-1354.

New from **Fotec Inc.** is a hand-held fiber optic power meter, the M300. Two pushbutton controls choose measurement units and calibration wavelengths (selectable 850 nm, 1300 nm and 1550 nm). Designed for simplicity and ease of use, the M300 provides complete usage instructions on the rear of the unit. The unit lists at $1,150. For more information, call (800) 537-8254 or (617) 241-7810 in Mass.



Fotec's M300

FM Systems has announced its new stereo performance meter that measures the stereo separation of source program audio content. The SPM-1 is designed to measure the stereo separation of actual program material, and separation of recording/playback, stereo multiplexing and transmission channels using program audio signals and test tones.

FM System's stereo performance meter

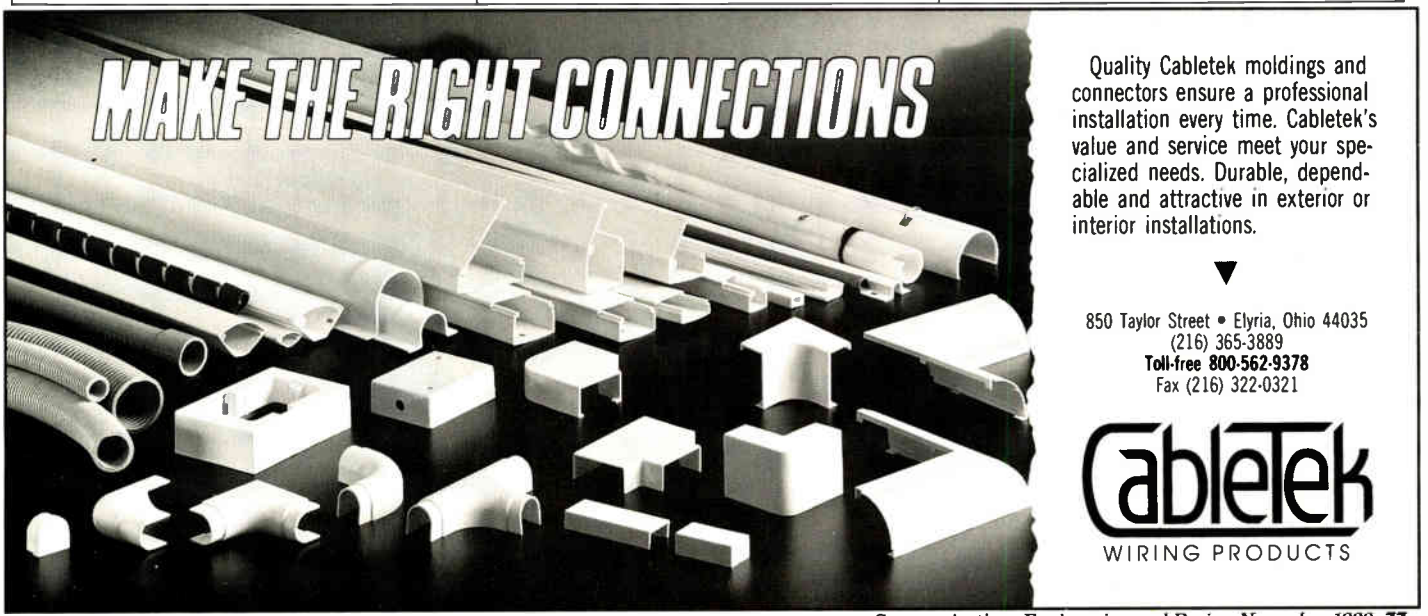
The stereo separation display is a bar graph calibrated in 1 dB increments. The display can be placed ontop of the VU meters on the console or incorporated into the VU meter display panel. Either way, the left and right input is high impedance bridging and can be connected to any normal 0 dBm, +4 dBm or +8 dBm line level. For more information, call (800) 235-6960 or, in California (714) 979-3355.

Rep agreement penned

Jerry Conn Associates has announced a sales representation agreement with **FITEL General, Inc.** which includes fiber optic cable and components. The agreement covers the Mid-Atlantic and Southeastern portions of the United States. FITEL is a joint venture between FITEL and General Cable Company Products which produces optical cable products. For more information on FITEL products, contact Jerry Conn Associates at (800) 233-7600 or, in Pa., (800) 692-7370.

New from **Meson Design and Development** is the JU-414 bare fiber adaptor. The unit is designed to easily test unconnectorized fibers by temporarily terminating a fiber into an industry standard connector. The JU-414 is available in both 125 μM and 140 μM sizes. Also, the JU-414 is

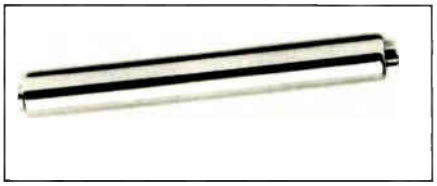
Meson Design and Development's JU-414



available as part of a kit which includes the bare fiber adapter and several connector bodies. For details, contact Meson at (800) 45-MESON.

Microwave Filter Company has announced its new Model 5KBP bandpass filter, which eliminates wideband noise caused by agile modulators or permits viewers to watch pay channels during a promotion period.

Since agile filters are not channel filtered, they can create an unacceptable noise floor with the addition of several modulators to a system, company officials say. The 5KBP fits into the modular output connector to limit wideband noise and passes a single channel (2 to 6). Channel loss is approximately 5 dB, with selectivity at 30 dB at ±6 MHz. The tubular unit is roughly eight inches long, weatherized and temperature stable with F-type connectors (male/female). Quantities of one to four are $39; five to nine are $33 and over ten are $28. For more information, call (800) 448-1666 or in New York, Hawaii or Alaska, (315) 437-3953.



Microwave Filter Co.'s Model 5KBP

New from **Photon Kinetics Inc.** is a new OTDR, the Model 3240, designed with built-in reflectance measurement and internal attenuation capabilities. According to company officials, the Model 3240 is designed for speed and simplicity, and makes fast, accurate measurements of optical fiber networks with up to 200 km range. The reflectance measurement determine the amount of light reflected by individual network components, with built-in attenuation to eliminate clipped reflections.

Photon Kinetic's Model 3240

The Model 3240 is designed specifically for cable television fiber applications, because high speed digital transmission rates are more susceptible to errors in data transmission that can result from reflections. According to Photon Kinetics officials, the single button operation of the Model 3240 is designed to make it easy for installation and maintenance crews to get precise reflectance measurements of network features.

Also new from Photon Kinetics is a

Photon Kinetic's Model 3300

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1A. Title of Publication	1B. PUBLICATION NO.	2. Date of Filing
CED	3 3 0 5 1 0	October 1, 1990
3. Frequency of Issue	3A. No. of Issues Published Annually	3B. Annual Subscription Price
MONTHLY	13	$36.00

4. Complete Mailing Address of Known Office of Publication *(Street, City, County, State and ZIP+4 Code) (Not printers)*

7 East 12th Street New York NY 10003

5. Complete Mailing Address of the Headquarters of General Business Offices of the Publisher *(Not printer)*

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6. Full Names and Complete Mailing Address of Publisher, Editor, and Managing Editor *(This item MUST NOT be blank)*

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William McGorry - Group Publisher - 825 7th Avenue New York NY 10010

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10. Extent and Nature of Circulation *(See instructions on reverse side)*	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A. Total No. Copies *(Net Press Run)*	17741	18250
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2. Mail Subscription *(Paid and/or requested)*	13273	13561
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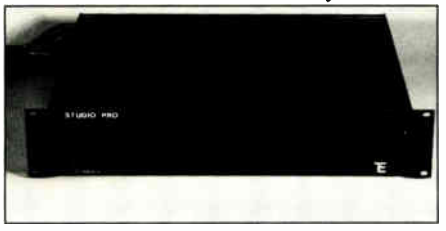
new field measurement service for single-mode fiber cables. The service combines Photon Kinetics fiber measurement experience and includes use of the company's Model 3300 portable dispersion measurement system and the measurement assistance of a Photon Kinetics applications engineer. According to company officials, use of the Model 3300 eliminates the need for a reference fiber by directly measuring the chromatic dispersion characteristics and spectral attenuation of all types of single-mode fiber. For more information, contact Photon Kinetics at (503) 644-1960.

New from **TE Products, Inc.** is the Studio Pro, a programmable machine control and switching system. The Studio Pro is an automation device designed to control eight playback machines (3/4 inch, SVHS 1/2 inch or laser disk) and two auxiliary sources.



TE Product's Studio Pro controller

By using an ANSI compatible terminal, the Studio Pro can be programmed for playback and simultaneous recording from an alternate satellite feed. The Studio Pro package consists of an ANSI compatible program control terminal and a two rack space unit containing 10 inputs with eight machine controller ports. Automatic switching for one or two outputs is done in the vertical interval, and optional SMPTE operation and stereo capabilities are available.

User selectivity of playback priority, sequential operation of a group of playback units, and spot random access of other units is also available. Keyboard selection permits the use of frame counting or park tones for program start identification. For more information, call (508) 788-0324.

Operators, please stand up

The SCTE's Committee on Interface Practices needs more operator involvement, says committee secretary Ken Williams, Raychem. "The majority of the faces at our meetings belong to manufacturers," Williams comments. "We simply need more operators." The objective of the committee is to create consensus on how standards should be developed, to provide standardization on methodology, and ultimately, to produce better products.

The group, which met last at the Atlantic City Cable Show, manages three subcommittees—the Drop Interface Subcommittee, Aluminum Interface Subcommittee, and Interface Testing Procedures Subcommittee. Recent developments in each sub group include:

Drop Interface. An accelerated salt fog procedure to measure the effects of corrosion exposure to F-drop interfaces was accepted (but not yet voted upon and approved by the subcommittee) as an interim recommended practice. Also, work commenced on the development of test instrumentation correlation methods for shielding effectiveness measurements. "The objective here is to provide a method for organizations to compare shielding effectiveness numbers, even though they may have used different equipment," says Williams.

A recent effort of the subcommittee is to assemble an F-drop cable specification which addresses dimensional issues, electrical and physical properties, and performance. An ongoing solicitation for input, particularly from cable operators, is in progress. To contribute, contact Dave Franklin, ATC, at (303) 799-1200.

Aluminum Interface. Work continued on developing a dimensional standard for the 5/8 inch male and female interface, with data collection on dimensions being solicited from component manufacturers and end users. "This work is important. It ensures that the electrical performance for higher electrical bandwidth will be there in the future for 1 GHz performance," Williams explains.

Interface Testing. An ink penetrant procedure was voted upon and approved by the subcommittee, in which cables and connectors are submerged into a shallow container of a red dye mixture and subjected to a temperature cycling. The components are then dissected to discern the seal quality.

The SCTE's Committee on Interface Practices meets next at the Western Show, on the morning of Wednesday, November 28. A working group meeting to discuss the F-drop corrosion testing will be held at Raychem's offices on the previous morning, Tuesday, November 27. Again, operators are strongly encouraged to attend. For further details on meeting times and places, contact Ken Williams at (415) 361-2215. ■

—Leslie Miller and Roger Brown

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When one wire equals three wires

In several columns, we have explored video compression and how it can lead to a wide variety of new and exciting services. This evolution is based on the application of fiber to cable system design to yield bandwidths of 1 GHz or better. A 1 GHz system has 160 slots of 6 MHz each. The partitioning of this real estate in last month's column suggested 60 channels of ordinary NTSC, 30 channels of simulcast HDTV, and 4-to-1 or 5-to-1 compressed video on the remaining 70 channels. This results in a minimum of 280 additional compressed channels or a maximum of 350 channels.

Let's consider what this means for the telco video "wanna-be's."

Can't they count?

We keep hearing about "one wire to the home" to carry voice, video and data. The question this raises is—where? Where do the telcos want to install their proposed one wire systems? They might make sense in entirely new developments where no wires currently are run to the homes. In nearly all existing homes, a copper pair is already installed. For well over 80 percent of homes, a coaxial cable passes within an easy installation distance. Adding fiber to these homes must mean adding another—third—wire to the home. Or has the excitement over this high technology caused a temporary inability to count?

The telcos have promised us that fiber to the home will give us excellent quality voice service with high reliability. They have promised a wide range of "information age" services including but not limited to videotex, teletex, and software downloading. And they have promised video. They're not talking about just any video, they want to give us digital high definition television and video on demand (VOD).

Let's examine what we already have. I, for one, have excellent voice quality phone service with high reliability anywhere I travel, as well as at home. If I have any problems at all with telephone service, it's usually with getting a long distance connection from a hotel which uses an "alternate carrier." Or, with understanding all the separate charges on my phone bill. This has nothing to do with whether the local loop is made of copper, fiber or wet string. I guess the only thing I don't have is VOD.

It is interesting to note that while the telephone industry talks about all these advanced services, they have difficulty selling rather ordinary phone services. Only about half of residential customers have touch-tone service! Only about 15 percent have advanced calling services, such as call waiting, call forwarding and conference calling.

What cable can deliver

Cable can now deliver a large number of channels *simultaneously* via a broadband feed. That's important because it means that the several television receivers and VCRs I already have can be conveniently connected and served with cable. Unlike the phone company's digital solution, I don't need a separate box for each VCR and TV. My family and I can watch as many different channels as I have television sets. In the telco digital case, four or six separate channels are proposed at one time. More channels will cost more money. This is not enough.

DigiCipher has taken away one more exclusive from the telcos. Cable can now also deliver "digital" HDTV. We've been able to deliver analog HDTV for quite some time; now we have both flavors.

Cable has teletext on several channels in nearly all households. "World system" style teletext is in the vertical interval of several superstations. All that is needed is a teletext decoder. These are available in several hundred thousand Zenith digital televisions.

In the relatively near future, fiber will allow for expanded services such as those outlined last month. Near video on demand, NVOD, is the engineering approximation of VOD. It achieves most of the functionality of true VOD at a small fraction of the cost. For example, the 10 most popular two-hour movies could be repeated every 25 minutes. This means that the average wait for a movie would be 12.5 minutes. That's less time than it takes to drive to the video store. Two major advantages are that a tape doesn't have to be returned and the customer is assured of getting what he wants.

A relatively simple microprocessor program could keep track of time so that if the subscriber wanted to take a break, he could return to the channel without missing any of the movie. Movies of less popularity could be repeated on a longer cycle. It becomes a marketing task to create an optimum schedule of movies and repeat times.

"Switched video" is yet one more telco promise. Each home would have its own channel and a video switch at the central office would make connections. The cable system described above could do much the same. Because only about 300 homes are fed with one fiber, each home could be allocated a channel. A more economic approach would calculate how man channels are needed on a statistical basis so that every home could use one of the switched channels nearly all the time it needed access.

An important question

Essentially every service imaginable has been provided either on the existing telco copper pair or on the cable's hybrid fiber/coaxial link to the home. The question remains: what new service or benefit comes from adding a third wire made of glass to the home? How can that expense be justified? There appears to be no rational answer!

If fiber was installed to the home to carry switched high definition television, there would be a tremendous asymmetry between the data rates for video and voice. If the video data rate was affordable, wouldn't the voice data rate have to be free? If the voice data rate was comparable to today's voice charges, wouldn't the video charges have to be astronomical? ■

By Walter Ciciora, Vice President of Technology, American Television and Communications

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