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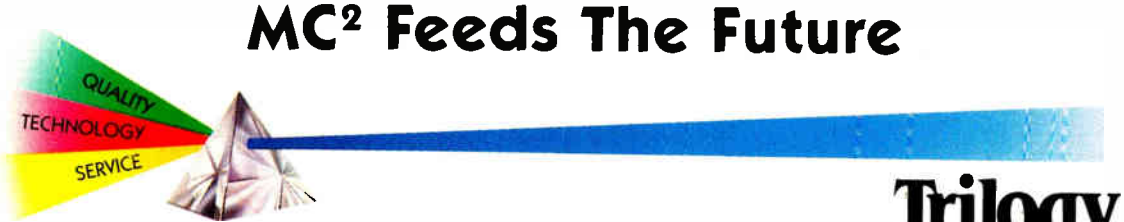

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Paradigm shifts and non-linear thinking

For many cable industry veterans, last month's National Cable Show in San Francisco must have had a deja vu-like quality to it.

Just as in cable's glory days of a decade ago, this year's national convention was filled with glitter, gloss and demonstrations of how the cable industry can take a lead role in changing the way Americans shop, learn and communicate.

Ten years ago it was interactivity via Qube that promised to have viewers using their television screen for applications such as shopping at home, distance learning, home security, banking and the like. This year interactivity made its comeback.

Not since the first days of fiber optics five years ago has the show floor been littered with so many "technology demonstrations" and "vapor ware" prototypes–products that portend the future and tease us with their capabilities. Exciting, vibrant times are upon us again.

What makes all the promises seem so real is that they're being backed by huge, successful companies. Time Warner has selected Silicon Graphics to supply the "engine" for the Full Service Network in Orlando; Scientific-Atlanta is now partnering with Motorola and Kaleida Labs to develop interactive set-tops; Jerrold-General Instrument is doing the same thing with Intel and Microsoft; US West bought into Time Warner to develop broadband networks; Toshiba and S-A are building set-tops for Time Warner's Orlando project.

What is clear is that this is indeed the era of strange bedfellows. Just a few years ago, the cable industry knew little about what was transpiring in the Silicon Valley, was trash-talking with the telephone industry about who was going to eat who's lunch, and was mired in a recession.

Now the industry finds itself perfectly positioned to capitalize on interactive, multimedia services and new joint ventures are the norm. Operators and their partners are betting millions that the new generation of Americans that have grown up with television and computers will spend money on services that combine the two platforms

Consumers are once again going to have a lot of technology thrown at them. The hope is that this time the equipment is actually so easy to use it becomes transparent. Certainly, the horsepower is there to make that happen. Now, will the dogs eat the dogfood?

Roger J. Brown

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WAVETEK

Adelphia's Liberatore: All the right stuff

By Leslie Ellis

Twenty years ago, while the cable industry braced itself for the introduction of satellite-delivered channels and massive expansion, Dan Liberatore was spending his quiet, West Virginia evenings in a shack behind the home of his boss, cable pioneer Don Levinson. As he describes it, Liberatore spent these early cable days working in the field on Levinson's Wheeling-based system. Then, after work, Levinson would call him over to tear apart equipment and see how it worked. "I'm certain he knew the answers to the questions he asked before he even asked me," Liberatore says of his mentor. "But it was his way of challenging me to learn and grow."

It was a union that affected Liberatore more than he may now realize. A typical Levinson challenge would go like this: "Dan, why 75 ohms?" He laughs as he recounts the story, but now admits he does the same thing as VP of engineering for Adelphia Cable. "I often play the devil's advocate when employees tell me of a decision they've made," Liberatore says. "It sounds like I'm asking dumb questions–but the intent is to encourage them to think and grow."

Liberatore worked in his home state of West.Virginia for seven years, until Levinson sold the Wheeling system to TCI. Then, he packed up and headed for Cincinnati, to build a Qube system there. He was hired as a staff engineer working for the company's Qube project manager; shortly after his arrival, the project manager quit. Liberatore was quickly repositioned to manage the project.

"It was pretty scary, because I had never done anything like that before–basically a baptism by fire situation," Liberatore recalls. He says perseverance and an overall love for the industry is what saw him through the citywide build–not to mention the many friendships made along the way. "There's a lot of Qube graduates out there," Liberatore laughs. "We have little reunions when we run into each other at shows."

In 1986, Liberatore again packed his bags, this time for Coudersport, Pa. (population 2,800 and known by Pennsylvanians as some of the best and most scenic deer-hunting turf around–even the schools close on the first day of hunting season), where he was hired by Adelphia as its VP of engineering.

Liberatore started "amidst a huge growth period for Adelphia," he says, and spent his early years there managing builds, rebuilds and upgrades. The company is now known for its significant strides toward passive network topology design, PCS experimentation and regional hub implementation, all under Liberatore's direction.

Current project load

"We're doing a lot of network things, like limiting amplifier cascades to one or two," Liberatore says of Adelphia's work on a passive network in development in Syracuse, N.Y. The project, which will culminate toward the end of 1994, will consist of "a fiber node and then a post amplifier pretty close in after that," Liberatore says.

He hopes to take the concept even further in the near future. Saying that Syracuse is ideally suited for the network–densely populated, very compact and circularly shaped without many extensions–Liberatore says he's eager to investigate similar networks in "less perfect" areas. "We're looking at some plans now that are long and sprawling and have a range of densities. Those things are a little harder to do with passive plant."

Meanwhile, the company has applied for FCC pioneer's preference status in the area of personal communications systems, where Liberatore says he's mostly focused on determining maximum cell size. "We have four tests sites, but most of the work is going on here in Coudersport," he says. As if that weren't enough, Adelphia is putting the final touches on what Liberatore calls a "tightly-coupled fiber SONET ring" in the state of Vermont.

"We're working on it with CableLabs. There's only a couple more pieces to put into place before it's completed, and we're actively discussing all the possible applications now," Liberatore explains. Those applications will likely include headend interconnects, regional advertising insertion, medical imaging and competitive access.

It's clear that Liberatore's leadership skills are in full demand these days–but he certainly isn't unprepared to meet the challenge. He completed his undergraduate work at the University of West Virginia, where in 1972 he earned a bachelor's degree in electrical engineering. True to his curious and people-oriented nature, he has taken several graduate-level classes in engineering management at the University of Massachusetts.

Liberatore cites management as an ongoing and somewhat fluid goal. "Our business is growing quite a bit. Professionalism is changing. That's what I enjoy the most: sharing my enthusiasm about where we're going as an industry.

"People in general tend to get sucked into their own little ruts," Liberatore muses. "I try to share their ruts."

Liberatore describes himself as a quiet, serious person. (His wife of seven years, Kathy, tells him he's too serious, he says.) But perhaps it's this pensive introspection, coupled with an advanced sense of humor and a single-minded focus to propel his employees toward personal growth and achievement, that makes Liberatore such an engaging, personable industry leader.

Activity in the SCTE, IEEE and the Professional Society of Electrical Engineers rounds out Liberatore's professional life. On the personal side, he and Kathy are raising three children, all at or near their teen years: Noah, 16, Christian, 13 and Erica, 11. They get out to Colorado "about once a year," he says, to downhill ski. "My goal is to ski a double black diamond run without breaking a leg, before I get too old," the 43-year old Liberatore laughs.

Liberatore humbly insists there's nothing innately interesting or funny about him. "I'm not a private pilot, or a gourmet chef, and I'm not an Elvis impersonator," he laughs. Maybe not, but chances are he has the answer to Levinson's question, now 20 years old.

So, Dan: Why 75 ohms? CED

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Cable Act of '92: About as clear as mud

By Wendell Bailey, VP of Science and Technology, NCTA

The recently enacted provisions for rate regulations and how they will be implemented and administered are really convoluted.

The Commission announced its decision on the rate regulation proceeding, saying it would roll back rates 10 percent or so for cable systems, and freeze rates and rate increases for 120 days.

When rules finally were released, they came to over 500 pages, including spreadsheets, charts, graphs, forms and formulas that (at least theoretically) would allow anyone to simply write in a few facts and figures relating to their cable system. The "fill in" items relate to number of channels, how many satellite channels vs. how many were off-air channels, how many were locally originated and how much is charged for different levels of service.

Do a little math, move a few numbers, multiply by this, divide by that, and BINGO, you come out with a per-channel charge. This was then compared to a "benchmark rate" which was determined by the examination of similar factors in what the Commission calls "competitive cable markets."

While this sounds simple enough, it really isn't. First, the competitive systems that the Commission examined to determine the benchmark have no requirement to be anything like your system.

Secondly, even if you find yourself at a point where the rate you can charge is understandable according to the calculations, the only way to add equipment or services to your system is probably (and this isn't completely clear) to enter into something called a "cost of service hearing," in which you have to do a great deal of accounting and analysis and reporting and have regulators decide whether you are doing things in a good, business-like way.

Regulatory hoops

So far, it seems this last point is the main thing concerning technologists. With the use of fiber optics, the possibility that we'll be going to compressed digital transmission of multiple NTSC channels, and the coming of HDTV and multimedia services, we all wonder whether any of these things can be added if we have to go through regulatory hoops to prove there is a business to offer.

It also seems that when it comes to plain old vanilla service we have some technical issues to deal with, like what sort of set-top device to make available to our customers. One thing is clear in this rate proceeding: we appear to have had an unbundling of our in-home equipment from our service charges. The cost contribution that a convertor/descrambler makes to a monthly charge must be separated from that monthly charge so everyone can see it. But seeing it isn't the important part. The important part is that should the consumer not need or use a descrambler, the cost of the cable service connection will be less. The rules allow a cable operator to recover the costs of this device.

Cost is made up of a variety of things, such as the amount of money spent to buy the unit, the amount spent to pay interest on any debt needed to purchase units, costs for maintenance etc., as well as a "return on investment." So far, the information on this return on investment part leaves many cable operators who have examined the rules to feel that it's not the same return they would normally assign to a project. Of perhaps more interest is the issue of where exactly this equipment needs to be and how you've deployed it and whether or not you can recover your costs directly. For instance, if the equipment is outside the premise, like pole-mounted security of some sort, it's not clear whether the costs associated with that port for that home have the same rights, so to speak, on the spreadsheet as a set-top device.

Quirk: Two different proceedings

Another strange quirk in the rules is that there are two different rate regulation proceedings, one that is conducted by the local franchise authority and relates to basic service rates, and another which relates to non-basic service rates and is conducted by the FCC. So if you were to add, for instance, some premium services that were scrambled and addressable hardware was your choice of technologies, you would naturally assume that the cost of that hardware would be adjudicated, if necessary, in a rate regulation proceeding at the FCC, since these were non-basic services that were controlled by the addressable hardware.

The Commission in its infinite wisdom, however, has decided that if any basic channels go through this box then the basic rate regulation proceedings are the appropriate venue for discussing the cost of this piece of equipment. When the FCC tried to explain this with a televised tutorial on the charts and graphs and forms and formulas, the meeting room was packed. TV stations all over Washington were tuned to the Washington Connection,a channel that shows FCC public proceedings, closed circuit transmissions were routed to other parts of the Commission building while the people who wrote the rules and regulations answered questions and gave examples.

At one point, after a series of questions from astute reporters about how certain pieces of the formula worked, one of the chief architects of the formulas and regulations was heard exclaiming that "we didn't do a very good job of being clear, did we?" While that would make an appropriate epithet, I'm afraid there is one other side of this issue the FCC and Congress ignored and continue to ignore. What does all this do to the investment in technology that the cable industry is poised to make? If a cable operator takes a major hit by a direct rate rollback and has to put up with the expense of rate regulation proceedings and the vagaries that they were likely to entail, how will technology projects fair? In the conversations I've had, most everyone believes technology is our future.

Perseverance is what I see everywhere when it comes to the issue of investment in our future. While many operators tell me it will be hard, none of them think we should hold back on bringing the new world of telecommunications to our customers. CED

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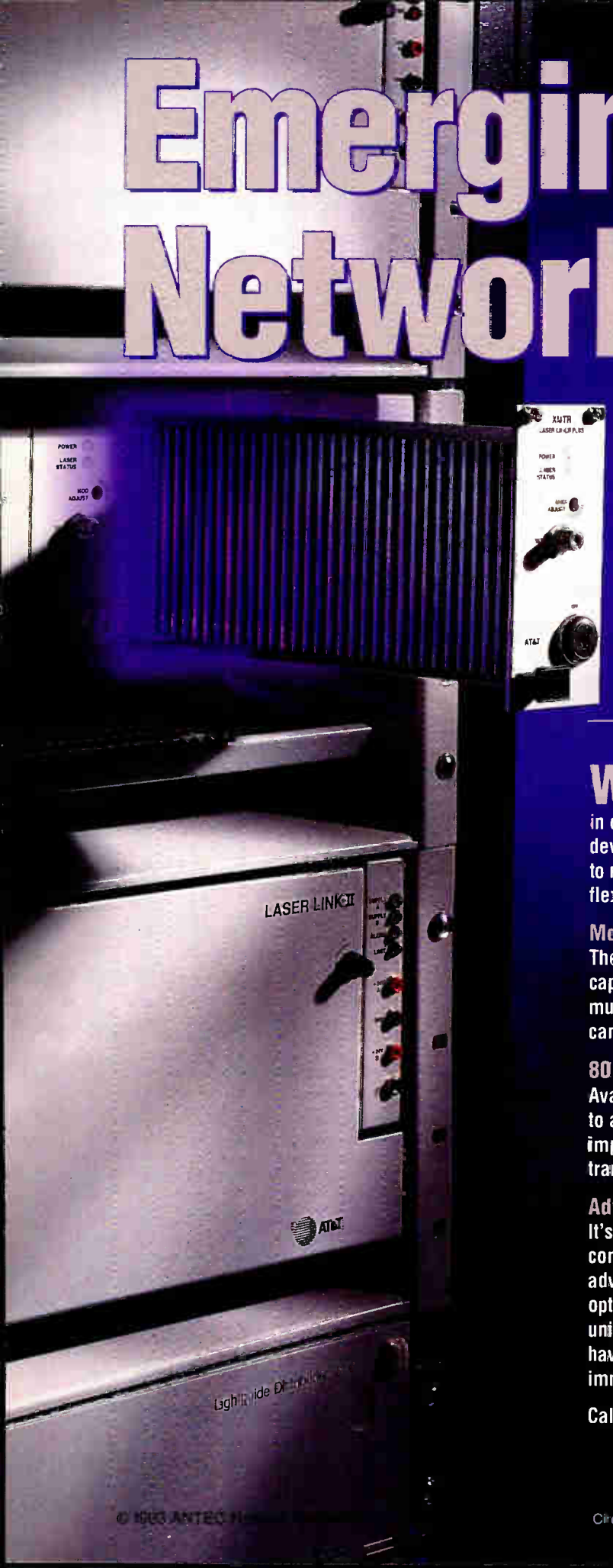

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Resonant circuits, filters and traps: A Tutorial

By Chris Bowick, Group Vice President/Technology, Jones Intercable

I have heard discussions of tiering, pay, and "a-la-carte" packages, using "traps", that would require quite a large number of these devices to be placed in series. While the operational implications with respect to truck-rolls and maintenance could certainly be immense and would certainly increase substantially as the number of traps per drop increases, there are also an immense number of technical and performance implications to the use of a large number of these devices on a single drop.

For these reasons, the next several columns will deal with the basics of filter theory.

Before we dig into the gory detail, however, it's probably best to get a few definitions out of the way. In our quest toward the ultimate goal of revealing the inner workings of a trap, we'll start with an examination of band-pass filter techniques, and eventually migrate the discussion toward the trap.

The resonant circuit

The resonant circuit is certainly nothing new in RF circuitry. It is used in practically every electronic device we come in contact with every day, including receivers, modulators, trunk amplifiers, set-tops, and, of course, traps.

Resonant circuits are used for a multitude of reasons, and can be used to selectively pass (or stop) a certain group of frequencies from a source to a load while attenuating (or passing) all other frequencies outside of the passband (or stop-band). The "perfect" resonant circuit for most applications might look like Figure 1.

Here we have a perfect rectangular-shaped passband with infinite attenuation above and below the frequency band of interest, while allowing the desired signal to pass completely undisturbed (purists are having a cow right about now because of the theoretical implications of such a heretical thought to both the signal and the network–but bear with me).

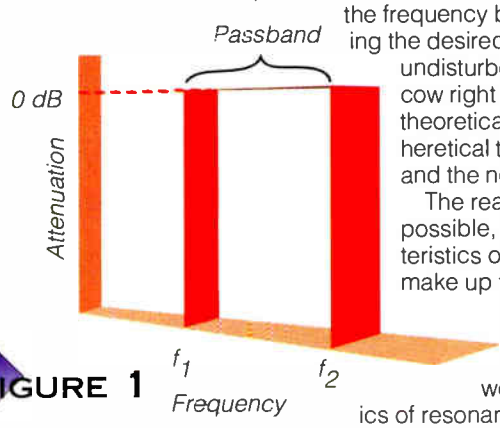

FIGURE 1

The realization of this filter is impossible, due to the physical characteristics of the components that make up the filter. There is no perfect component, so there can be no perfect filter. However, in most cases, if we understand the mechanics of resonant circuits, we can tailor an imperfect circuit to suit our needs almost perfectly.

Figure 2 is a diagram of what a practical filter response might look like. Outlined below are some appropriate definitions for the filter that exhibits such a characteristic shape. These definitions are appropriate in order to prepare for the more complex information that will be provided in future columns.

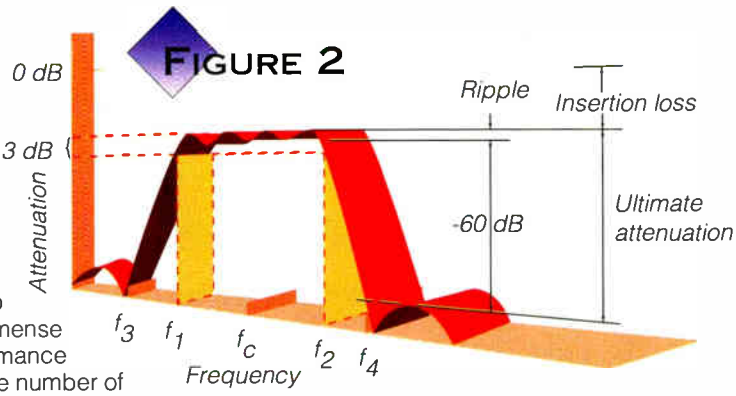

FIGURE 2

Bandwidth–The bandwidth of any resonant circuit or filter is most commonly defined as being the difference between the upper and lower frequency (f_2-f_1) of the circuit at which its amplitude response is 3 dB below the passband response. For this reason, it is often called the half-power bandwidth.

Q–The ratio of the center frequency of the resonant circuit or filter to its bandwidth is defined as the circuit Q. $Q = f_c/(f_2-f_1)$

The Q of a filter is therefore a measure of the selectivity of the device. The higher its Q, the narrower its bandwidth, and the higher will be the selectivity of the circuit.

Shape Factor–The shape factor of a resonant circuit is typically defined as being the ratio of the 60 dB bandwidth to the 3 dB bandwidth of the circuit. Thus, if the 60 dB bandwidth (f_4-f_3) were 3 MHz and the 3 dB bandwidth (f_2-f_1) were 1.5 MHz, then the shape factor would be 3 MHz/1.5 MHz or 2. Shape factor is simply a degree of measure of the steepness of the skirts of the filter. The smaller the number, the steeper the response skirts. Notice that the "perfect" filter of Figure 1 has a shape factor of 1, which is the ultimate.

Ultimate Attenuation–Ultimate attenuation, as the name implies, is the final minimum attenuation the filter presents outside of the specified passband. A perfect bandpass filter would provide infinite attenuation outside of its passband. However, due to component imperfections, infinite attenuation is infinitely impossible to obtain.

Keep in mind also, that if the circuit presents response peaks outside of the passband, as shown in Figure 2, then this detracts from the ultimate attenuation specification of that filter.

Insertion Loss–Whenever a component, or group of components, is inserted between a signal source and its load, some of the signal from the source is absorbed in those components due to their inherent resistive losses (more on this later).

Thus, not as much of the transmitted signal is transferred to the load as when the load is connected directly to the signal source (assuming that no impedance matching function is being performed). The attenuation that results is called insertion loss, and is a very important characteristic of filters. It is usually expressed in dB.

Ripple–Ripple is a measure of the flatness of the passband of a filter and is also expressed in dB. Physically it is measured in the response characteristics as the difference between the maximum attenuation in the passband, and the minimum attenuation in the passband. CED

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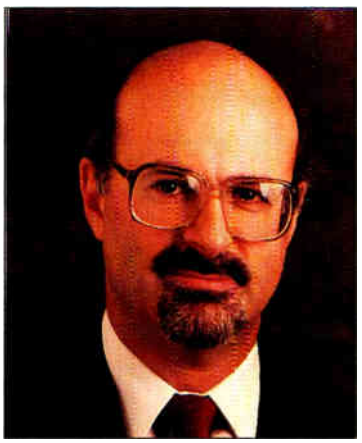

Rate regulation primer: The paperfest

By Jeffrey Krauss, independent telecommunications policy consultant and President of Telecommunications and Technology Policy of Rockville, Md.

To a cable operator, the FCC's 500-page cable rate regulation decision is one of the most complicated documents ever published. But 20 years ago, I worked for a communications common carrier and I was an expert on–guess what?–rate regulation. So this article is all about cost-of-service rate regulation. But if you didn't understand it before, you probably still won't understand it after reading this.

The regulated price for a service is called the "revenue requirement" in rate regulation jargon. The basic equation in public utility cost-of-service rate regulation is:

(Rate Base) x (Rate of Return) + Expenses = Revenue Requirement,

and this applies to each "service." In the telephone industry, the "services" might be local residential dial tone or interstate 800 service switched private line service. In cable, the "services" would be basic, cable programming (this is the FCC's term for satellite-delivered basic channels), pay-per-channel (premium) and pay-per view. Only the first two are regulated under the new law. The FCC decision allows either cost-of-service regulation or "benchmarking" for cable rates, but it requires cost-of-service regulation for equipment such as convertors and remote controls. The charges for this equipment must be unbundled from the service charges.

Revenue requirement

The regulated price or "revenue requirement" for a service consists of the return on investment plus expenses. The expenses that can be recovered include depreciation, interest on debt, maintenance and repair expenses, as well as direct operating expenses.

The "return on investment" is the product of Rate Base and Rate of Return. The Rate Base is the current value of the plant investment (capital cost less depreciation). The Rate of Return is a percentage value that the FCC sets, based on the cost of money and business risk. The FCC has set 11.25 percent as the rate of return for cable TV equipment, since this is the rate that the FCC has set for telephone companies. In more traditional accounting terms, this is your profit.

The depreciation expense depends on an accounting concept called the "depreciation life" of the equipment. This is a familiar concept to anyone who has ever run a business, partly because it plays a role in computing annual income taxes. But, because the tax laws and the rate regulation laws are different, the equipment depreciation life for tax purposes is likely to be different from the depreciation life for rate regulation. Yes, you must keep two different sets of books, one for taxes and the other for rate regulation.

The FCC plans to issue a Second Further Notice of Proposed Rulemaking "in the near future" to adopt depreciation life standards for cable equipment.

Another aspect of the Second Further Notice will be the question of disallowance of the interest paid on debt incurred to purchase cable systems. While regulated telephone companies are entitled to include all of their interest on debt as expenses that can be recovered, the FCC may decide that a cable system's debt interest should not be recovered. This stems from the feeling that there is too much turnover in cable system ownership, and the current owners have paid too high a price.

The FCC may decide to disallow the interest expense for debt that exceeds the replacement cost of the cable system. The typical price when a cable system is sold these days is more than $2,000 per subscriber, while the replacement cost is less than $1,000 per subscriber. Economists have argued that the large difference between selling price and replacement costs is due to the cable system's monopoly.

One tricky aspect of rate regulation is that the rate regulation equation applies to each service separately, but much of the plant investment and expenses are shared among several services. So the capital investment and expenses must be allocated among the services.

When an installer visits a subscriber and replaces a defective convertor, the cost of that visit includes the installer's hourly wages and benefits. In addition, "system joint and common costs" can be allocated to the service call. This might include portions of the depreciation on the installer's truck, the customer service department costs, the rental of warehouse space, etc.

For this example, once all of these indirect costs are allocated to the service call, the entire cost of the service call would be assigned to the cost of convertor equipment. But if it were a service call to restore a drop cable that was cut by a backhoe, then the total cost of the service call would be allocated to the various cable services: partly to basic service, partly to cable programming service, partly to pay-per-channel, etc.

These multiple of levels allocations have provided telephone companies with a great deal of flexibility, because they can use any reasonable allocation method. For example, they might allocate the cost of a switching machine in proportion to minutes of use for various services. A fiber optic system might be allocated in proportion to number of channels. The president's salary might be allocated in proportion to the revenues generated by the different services.

But the FCC is trying to cut down on flexibility for cable's cost allocations. The FCC has decided that most cable system costs must be allocated between basic and cable programming services in proportion to the number of channels in each tier. Franchise fees, however, may be allocated using a different allocator, such as number of subscribers for each tier.

Paperwork

Just to make sure that you know what to do, the FCC has created a new Form 393 entitled "Request for Cable Rate Approval." Just to make sure you get it right, the form and its worksheets and instructions are 55 pages long, and they read just like an income tax form. And just to make sure you use enough paper, it is full of instructions like: "Please attach an explanation of how you arrived at this allocation." CED

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Circle Reader Service No. 11

Digital video versus AM supertrunking: A CATV network cost and performance analysis

By Robert W. Harris
Sr. Applications Engineer - Fiber Optics
C-COR Electronics Inc.

A comparison of headend elimination methods is made between two types of fiber optic supertrunking: Lightly Loaded AM (LLAM) and uncompressed digital video. The overall cost and end-of-line performance impact on CATV systems due to headend elimination and consolidation is evaluated.

This analysis outlines the channel loading, performance, fiber requirements, cost and system compatibility issues for each supertrunking technology. The advantages and disadvantages of each method is discussed. Associated with each supertrunking method are cost and performance tradeoffs. It is found that the choice of supertrunking has a significant impact on the total CATV system upgrade/rebuild cost and overall system performance.

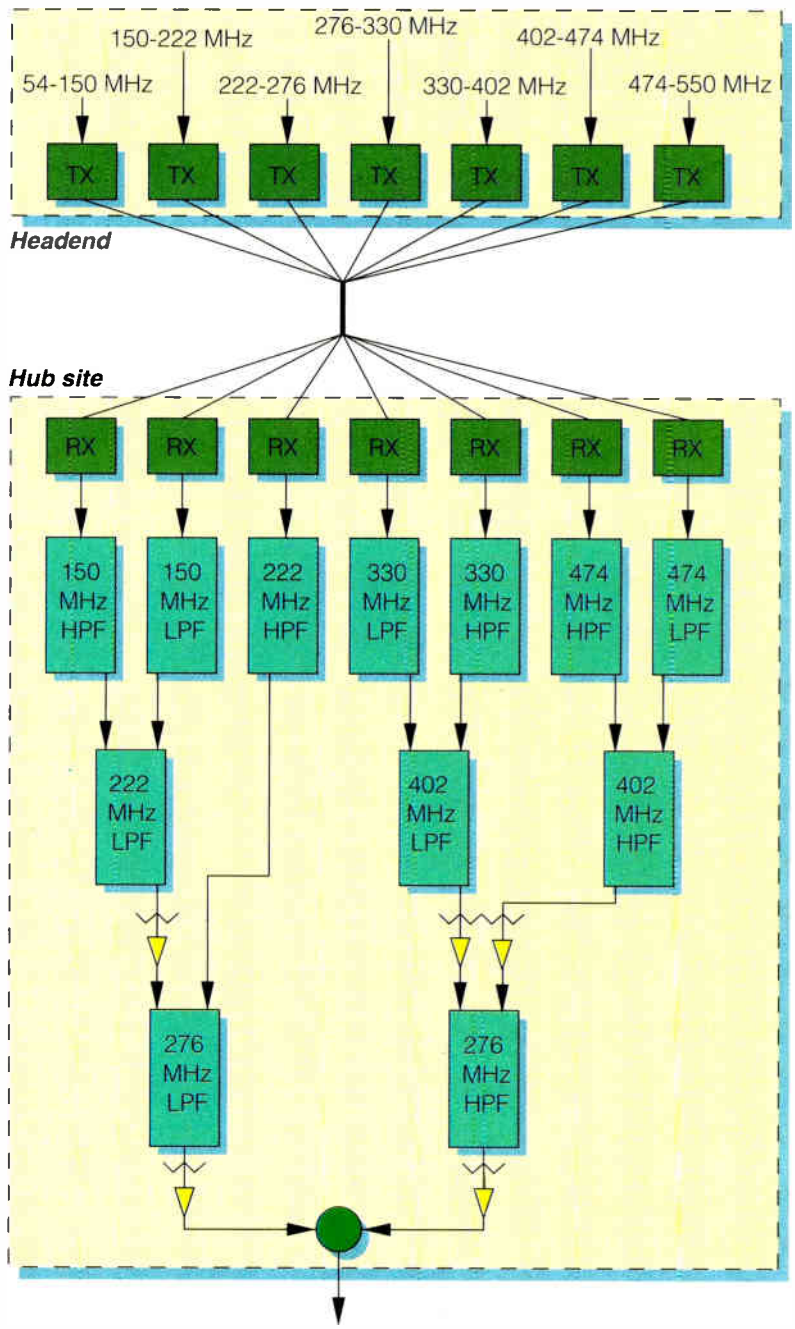
Introduction

As CATV systems evolve toward more sophisticated telecommunication networks, there becomes an increasing need to review the physical nature of multiple headends within a franchise area. The cable television industry has traditionally built complete headends for specific franchise boundaries and serving areas. This has led to multiple, or secondary, headends within a city or region.

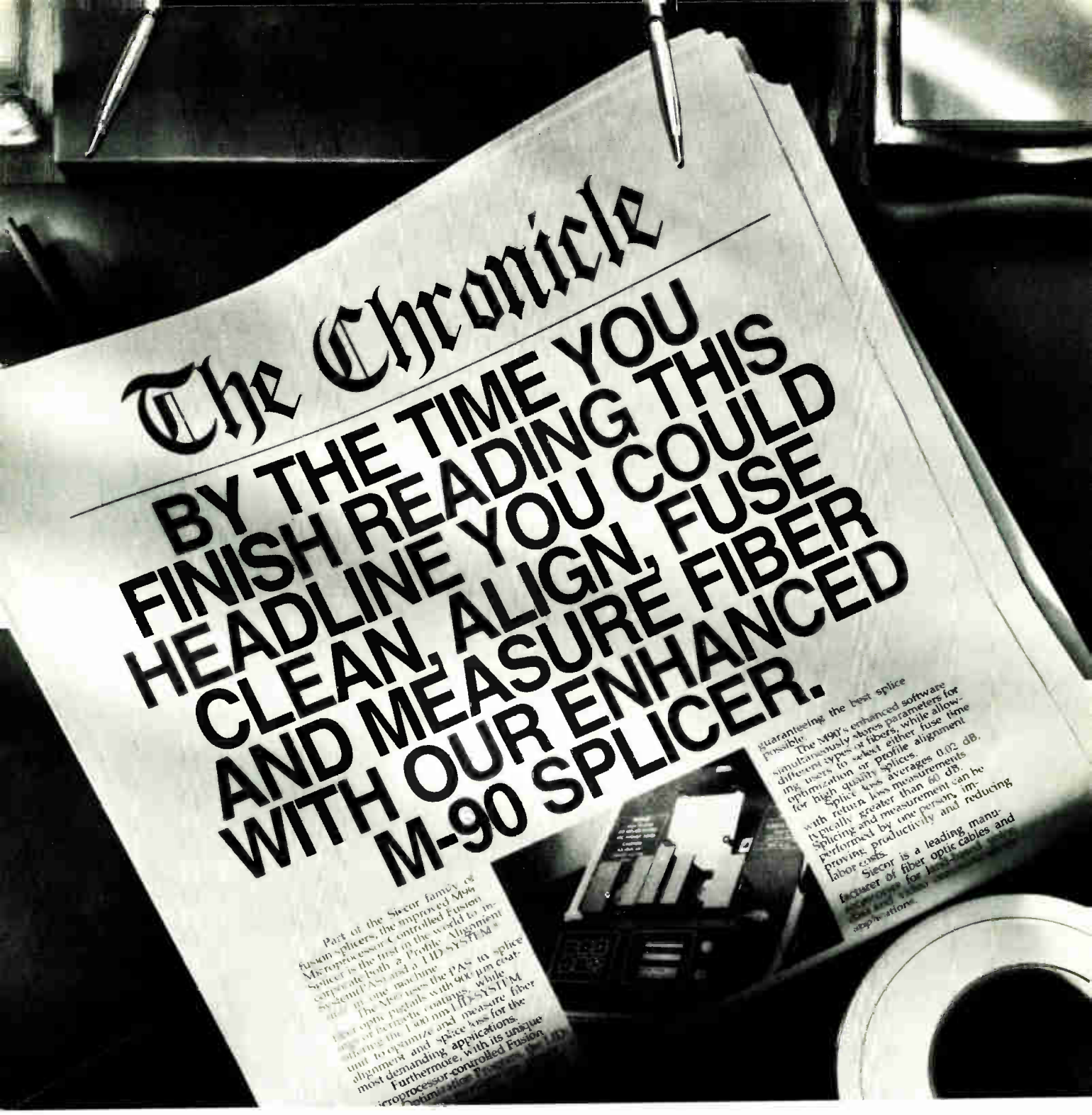
Even though a single operator may possess the franchise for the entire city or region, the size and serving area of many CATV systems makes it nearly impossible to serve all subscribers with high-quality performance from a single headend. The costs are relatively high when adding CATV headends with the associated earth stations, building, satellite receivers, modulators and maintenance. Hence, a technique known as supertrunking is used as a method to bring headend or near-headend quality signals to these locations to eliminate and/or consolidate these secondary headends at a lower cost.

The very concept of a supertrunk implies a high signal quality performance at the receive end. Ideally, a supertrunk will deliver a headend or near-headend quality signal performance at the receive site(s) or hub(s). It must be able to transport a variety of signal formats such as VSB-AM, baseband and RF scrambled video, digital data, future digitally compressed video, and provide an output that is easily interfaced with the CATV RF plant. It should have the capability to be upgraded and expanded for redundancy. It should have minimal maintenance requirements and not occupy a great deal of equipment rack space.

FIGURE 1
Lightly loaded AM (LLAM) supertrunk



Supertrunking is not a new concept in CATV. In the past, headend consolidation and elimination was accomplished through feedforward amplifiers, FM over coax, FM over fiber, and AML microwave. These technologies, while improving signal quality at the end-of-line (EOL), had their limitations with respect to transmission distance, performance, reliability,



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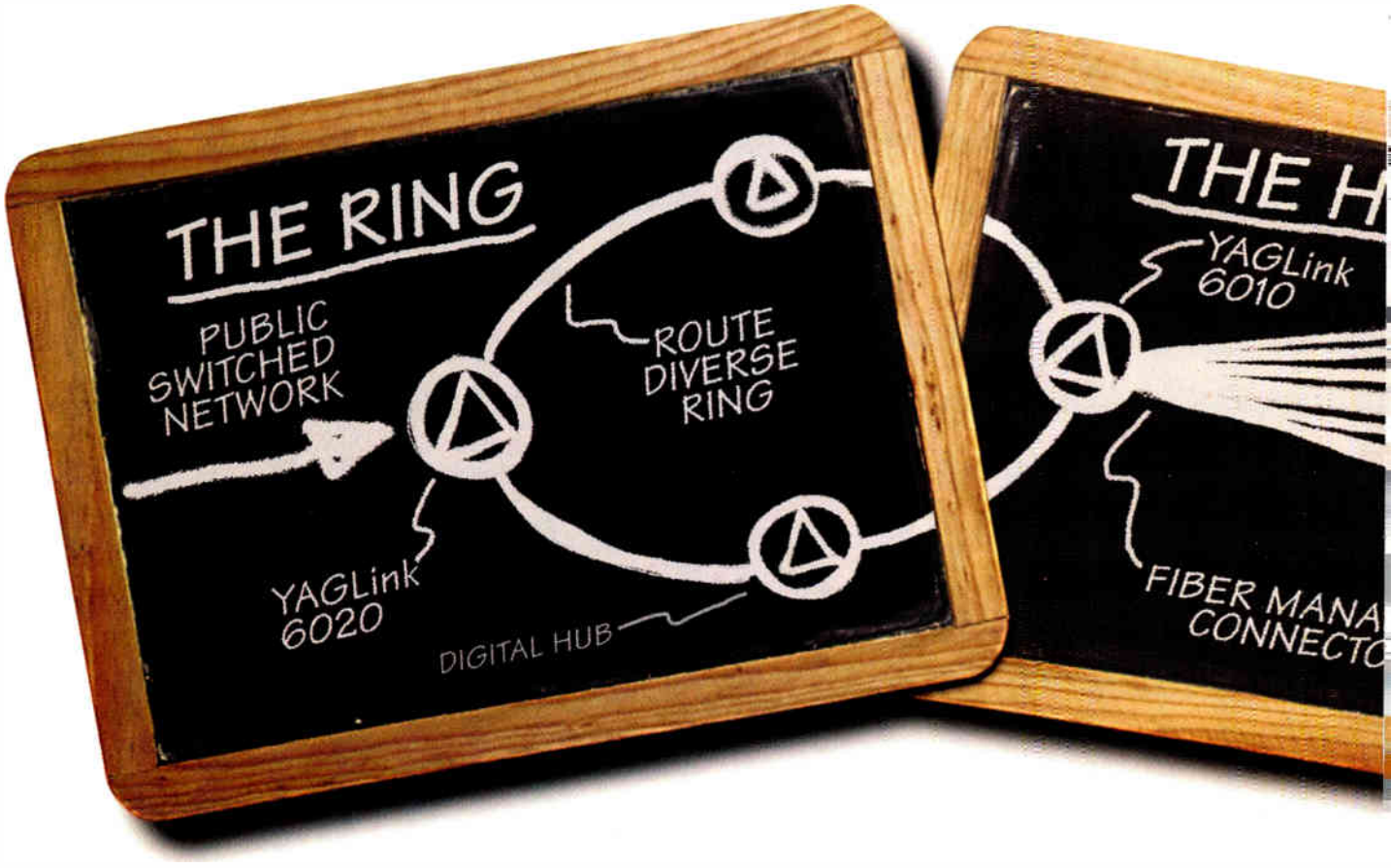

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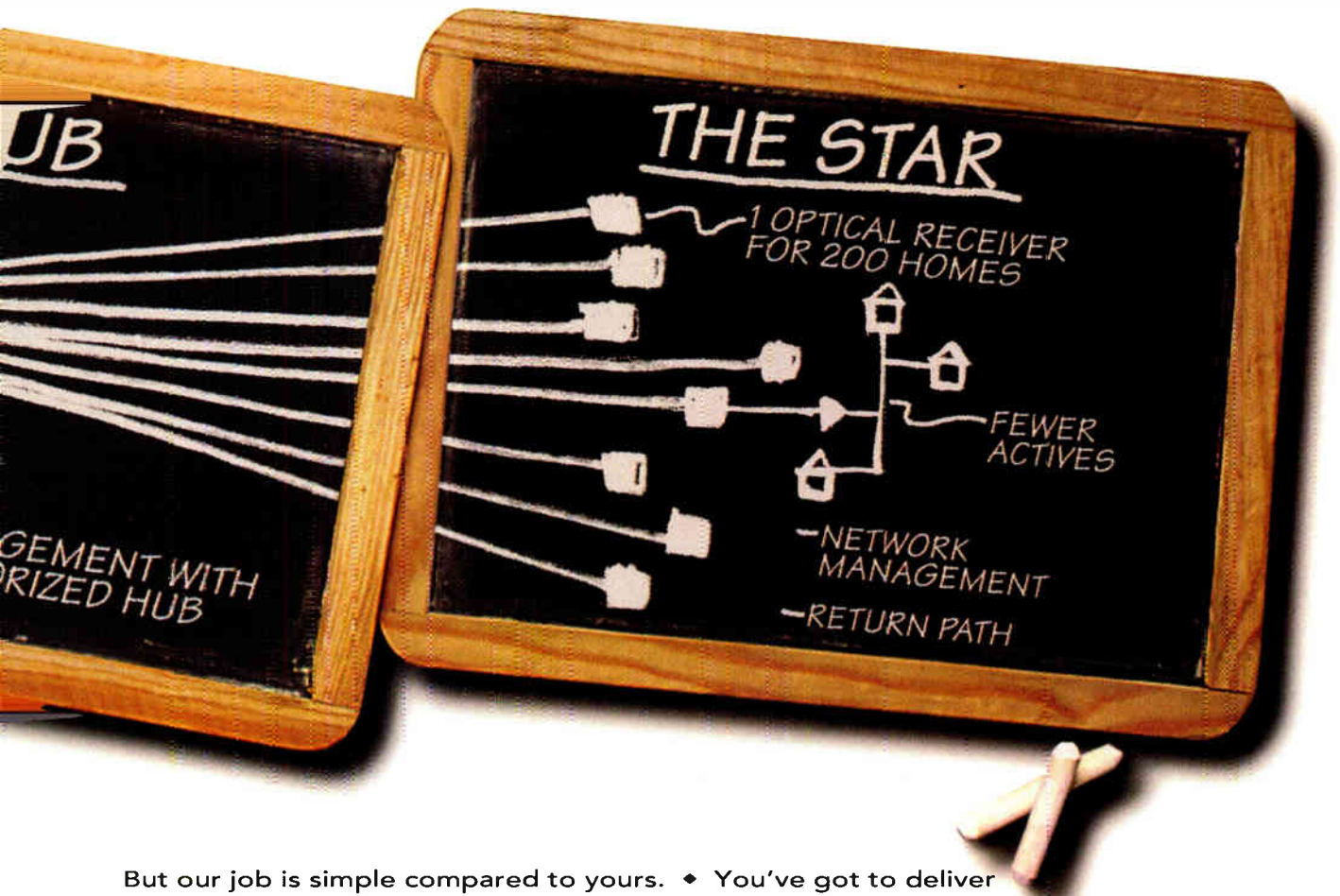

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maintenance and cost.

Over the past several years, advances in AM and digital video fiber optic technology have led to dramatic improvements in CATV network performance and reliability. This paper reviews the features of both AM and digital PCM (pulse code modulation) supertrunking and discusses the cost and performance impact on the CATV system when implementing each technology.

A comparison of headend elimination and/or consolidation is made between two types of CATV supertrunking: Lightly Loaded AM (LLAM) and 8-bit digital video transmitting at 1.6 Gb/s. This analysis describes the channel loading, fibers required, performance, configuration, cost and compatibility issues of each supertrunk technology. Additionally, sample designs have been completed which show the cost and performance of the secondary AM fiber links and RF distribution served from the supertrunk hub sites.

Lightly Loaded AM supertrunk description

AM supertrunking has been proposed[1] as a method for eliminating and/or consolidating headends. This approach utilizes a tiering method whereby nine to 13 channels of VSB-AM signals are directly modulated onto seven DFB lasers and transported over four 1310/1550 nm wave-division-multiplexed fiber links.

A block diagram of an AM supertrunk is shown in Figure 1. Seven fibers are used to transport the signals. If 1550 nm transmitters are used, WDM can be employed to reduce the active fiber count to four fibers. The frequency arrangement of each tier, except the first, is less than one octave so that the composite second order distortion (CSO) products fall out of the band being transmitted by the respective laser.

A comparison is made between lightly loaded AM and 8-bit digital video.

However, the CSO that falls out of one RF band will appear in another RF band. To reduce the effect of this problem, each frequency band is filtered such that the distortion products are not present after recombination of the various bands. Note that RF attenuators and post-amplifiers are necessary to obtain proper isolation and RF output levels. Through a 26 km path, the performance of the LLAM system is approximately 58 dB CNR, -71 dBc CSO, and -70 dBc CTB.

The rack space requirements for an AM supertrunk are modest. About 20 inches are required in the headend for all optical transmitter modules and redundant power supplies. The receive site also requires about 20 inches for all optical receiver modules, redundant power supplies, filters, post-amplifiers and combiners.

The number of optical fibers required for the application depend on whether or not WDM is employed. Without WDM, seven fibers are required. With WDM, four fibers are required and there remains an additional optical window on one of the three fibers. This additional window can be used for either return signals or more downstream signals above 550 MHz which may include digitally compressed video.

As with all AM fiber optic systems, the LLAM supertrunk performance is determined by a variety of parameters including laser and fiber characteristics, shot and receiver noise, OMI (optical modulation index) and CATV channel frequency. The intermodulation and distortion products (CSO and CTB) are a function of the OMI (optical modulation index).

Further, in 1550 nm AM systems, optimizing the overall system performance is

more complex. In both 1310 and 1550 nm systems, the OMI must be set high enough to achieve the desired CNR without clipping the negative peaks of the AM signal or causing excessive spectral spreading. In 1550 nm AM systems, excessive spectral spreading causes a secondary limitation in intermodulation distortion through its interaction with the fiber chromatic dispersion[1].

LLAM supertrunks can be considered when the hub sites and secondary headends to be replaced are between15 km and 35 km away from the primary headend. This means the LLAM supertrunk will operate through about 8 dB to 14 dB of fiber loss, assuming 0.4 dB/km at 1310 nm. The loss budget typically should not exceed 14 dB in order to maintain an adequate CNR performance.

After adding in connector, splice and WDM losses, little, if any, additional budget is available for splitting the optical output power from the transmitter in order to share one bank of transmitters with two hub sites. Therefore, when multiple hubs are served, the AM supertrunk requires a separate dedicated LLAM link (bank of transmitters and bank of receivers, filters and combiners) from the headend to each hub site.

Advances in digital technology have led to direct digital-to-IF processing.

Digital video supertrunking description

Uncompressed digital video transmission has been described[2] as another method for transporting headend quality video/audio signals to hub sites. It is based on 8-bit video resolution codecs that provide better than RS-250C medium haul performance at each hub site. The high speed (1.6 Gb/s) optical terminals, operating at either 1310 or 1550 nm, have an optical loss budget of 30 dB. A block diagram of a digital supertrunk is shown in Figure 2.

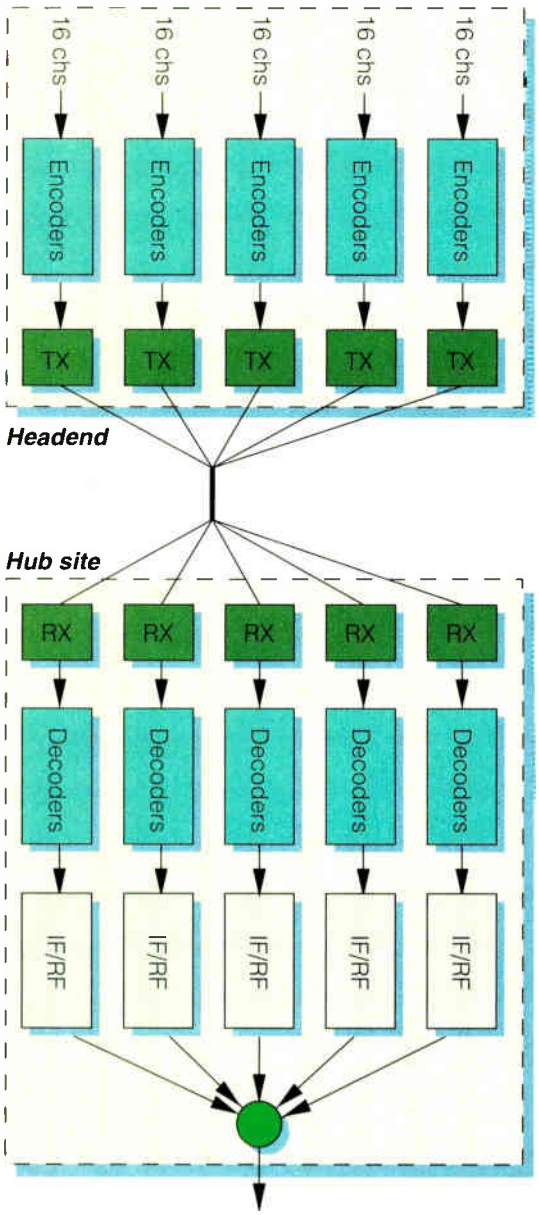
In an uncompressed digital video system, each channel is digitally encoded separately from one another then time-division-multiplexed (TDM) to create a high-speed serial data stream operating at 1.6 Gb/s. The high-speed data is then directed to the laser transmitter where it intensity modulates an FP or DFB laser diode.

Five fibers are shown transporting 80 digital video channels. WDM can be used to lower the active fiber count to three. There would also be an additional optical window available when using WDM which can be used for AM and/or digital forward or return signals[3].

The digital transmission system provides RS-250C medium haul performance, which is considered headend quality. Specifically, several measured video performance parameters include 60 dB CNR, < +33 ns C/L delay, < 1.3 degrees differential phase, <2 percent differential gain, to name a few. Also, because of the use of synchronous time division multiplexing within the digital network, no composite distortions are generated.

Advances in digital technology have led to direct digital-to-IF signal processing[4] and the ability to process all forms of baseband and RF scrambling. Digital technology also provides consistent signal performance at each hub which is not affected by channel loading, path loss variations or fiber chromatic dispersion as is AM fiber optic technology. Digital signals can be transparently dropped and repeated and new signals inserted at each hub. The digital network can be expanded to offer full optical component and path redundancy. Further, digital systems require little maintenance and no operational adjustments or optimization.

FIGURE 2
Digital supertrunk block diagram



An 80-channel digital system with RF outputs typically requires no more than one six-foot rack at the headend and about two seven-foot racks at the hub site. The digital transmit and receive equipment requires an environmentally controlled building.

Supertrunking cost comparison

A head-to-head cost comparison of both supertrunking technologies is given below for an 80-channel system with multiple receive sites. The LLAM system cost includes all optical modules, RF filtering and post-amplification. It is assumed that each of the hub sites are fed with a dedicated LLAM system, i.e., no optical splitting of the transmitters.

TABLE 1
Cost comparison between LLAM & digital supertrunk

Number of receive sites	Cost for LLAM system ($)	Cost for digital network ($)	Cost premium for digital ($)
1	120,000	325,000	205,000
2	240,000	525,000	285,000
3	360,000	725,000	365,000
4	480,000	920,000	440,000
5	600,000	1,120,000	520,000
6	720,000	1,315,000	595,000

The uncompressed digital fiber network, with a 30 dB loss budget, can employ optical splitting at the transmitter output to increase the transmitter-to-receiver ratio. Sharing the transmitters with multiple receive sites lowers the total cost of the digital network. The cost of the digital network includes modulators and/or IF-to-RF output convertors for delivering RF outputs. Both 1310 and 1550 nm optical terminals can be used if active fiber count is an issue.

Table 1 shows that on a head-to-head cost comparison, the LLAM system equipment cost is less than the digital video equipment cost. However, one must look beyond the cost difference between just the supertrunks and consider the overall impact on the CATV system EOL performance due to the finite composite distortions (CSO and CTB) incurred through the LLAM system.

In other words, how does the lower performing (near-headend quality) LLAM supertrunk affect the secondary AM fiber and RF cascade performance? Specifically, what impact does it have on the overall system cost? CED

These questions will be answered in next month's installment of FiberLine by modeling each approach in typical cable systems.

One must consider the overall impact on the CATV system performance

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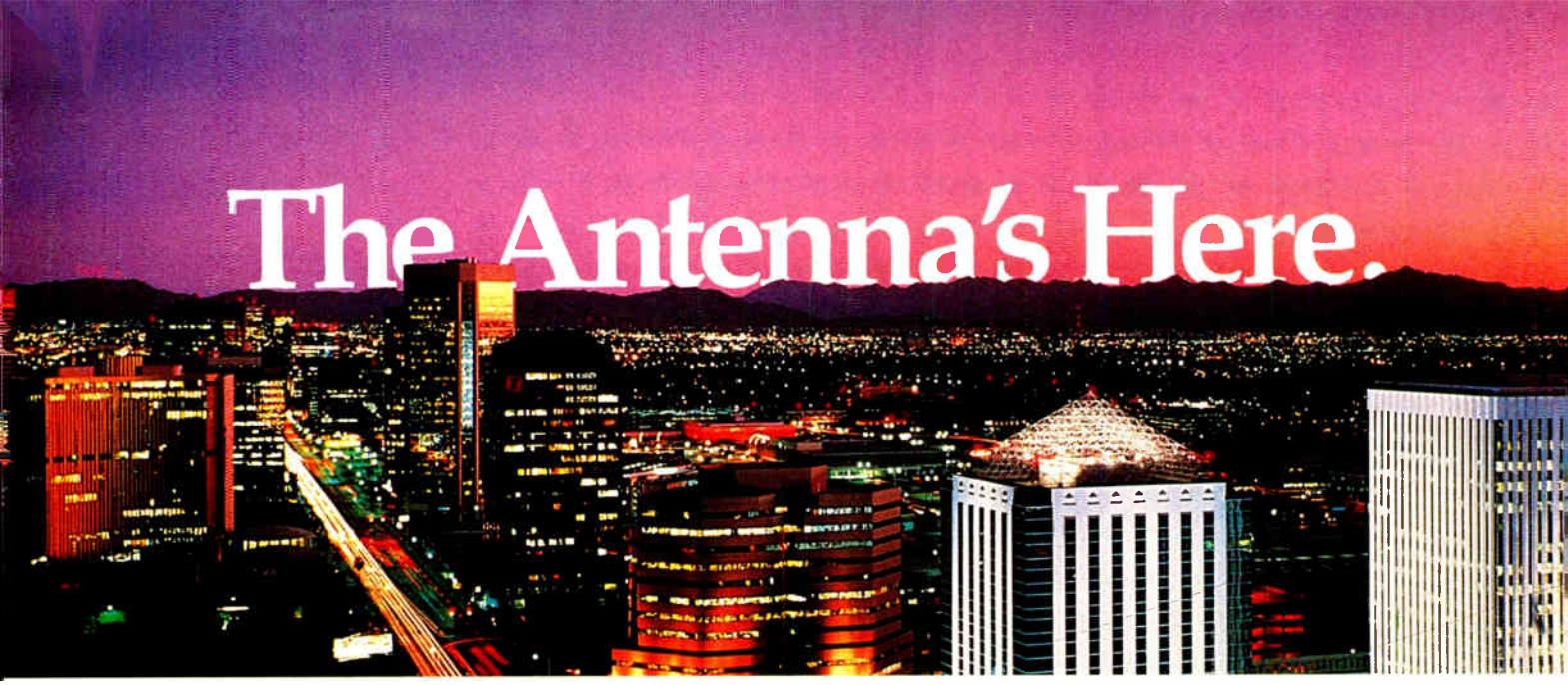

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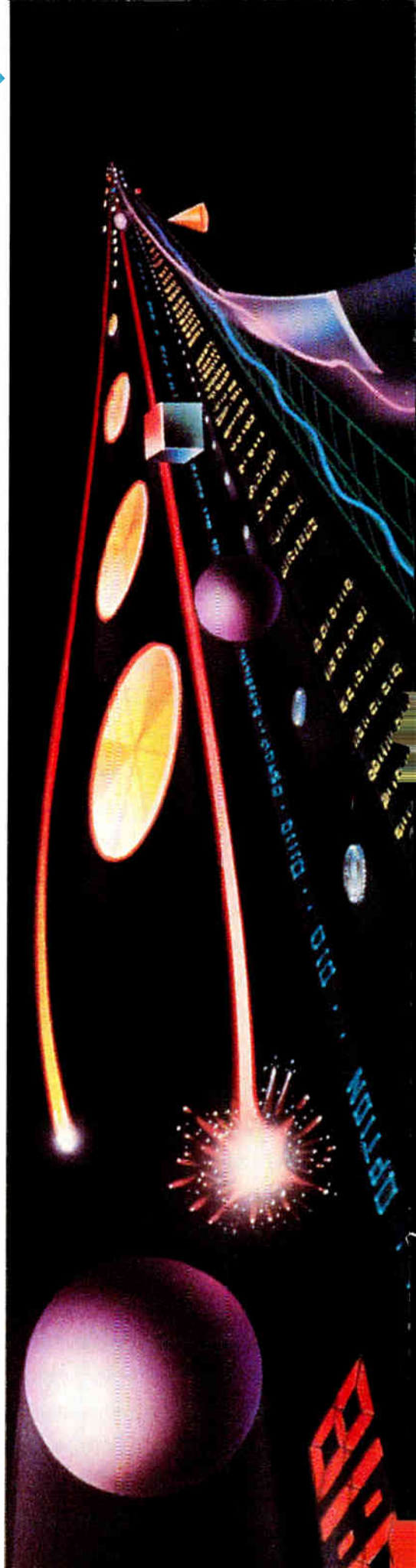
Circle Reader Service No. 16

Sorting out interactive technology

What options do operators have?



By Roger Brown, CED

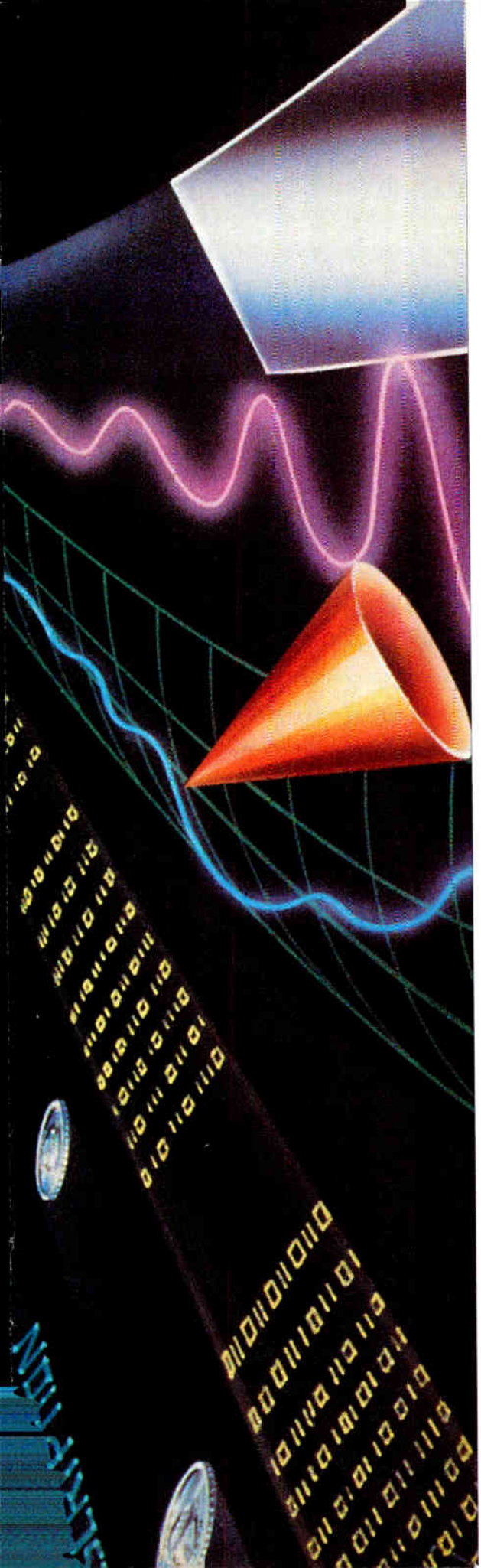
Making television less of a passive viewing experience and more of a participatory event has been the dream of many people for many years. Everyone has seen the hyperbolic marketing pitches where people are shown communicating with a distant relative or business colleague via the television, shopping for new clothes or groceries, monitoring their property, paying bills and playing games.

The problem is that while everyone has seen those demonstrations, interactive television has largely been a marketplace failure to date. Systems have been shown to work, but for one reason or another, they've been perceived to be novelty services that turn out to be either too expensive for consumers to pay for or not interactive enough to give people what they want, when they want it.

There has even been some disagreement over the definition of "interactivity." Does it have to be a real-time transaction between a program and the viewer, or will store-and-forward devices suffice? Can you get away with asking someone to pick up the phone anc make a call, or should it be the punch of a button or two?

Technology is the enabler

But now, new technology, combined with fiber optic and digital upgrades cable operators are making to their networks as a matter of course, promise to make real-time, two-way interactivity a reality at reasonable costs. As computer processing power becomes cheap, plentiful and packaged in small chips, suddenly cable operators will



have direct access to high-powered, intelligent set-top terminals that used to do little more than convert one channel into a different frequency slot.

Certainly, cable operators will venture into interactivity slowly. Outside of perhaps a few, highly publicized flagship systems. system managers will probably opt to use telephone backhauls as their method of exploring the interactive marketplace. If it appears there is money to be made, cable networks will then become fully two-way. Then the addition of a switching fabric will bring vast capability to virtually every household, as Time Warner is about to find out in Orlando..

Steve Dukes, vice president of advanced network development at Cable Television Laboratories, has been studying the various options cable operators have to deploy interactive services. Those options include a telephone return, wireless drops, a dual cable system where a separate coax is dedicated for the upstream traffic, to complex ATM switching. While it's unclear which method is ultimately the best, Dukes says it's important to balance expenses with revenues derived from the services offered.

"It is important that we follow the model of the (regional hub) architecture," says Dukes. That model advocates placing complex, expensive components at a central location until costs drop and the hardware can be moved closer to the home.

A CableLabs project headed by consultant Peter Miller is defining the applications cable operators might use. "It is extremely important to look at each application individually and aggregate them," Dukes says.

DON RILEY

A VCTV on-screen menu

Some efforts already underway

Already, several companies have developed and deployed some form of interactive technology, ranging from Videoway in Canada to ACTV, which has perfromed some cable tests. TV Answer has focused on the use of over-the-air frequencies and has only recently extended to olive branch to cable operators as a low-cost method of providing interactive services. Interactive Network, which received a $10 million cash and services infusion from TCI recently, is renewing its efforts to work with cable operators to develop technology and develop interactive games.

But, starting with TCI's video-on-demand test in Denver with AT&T and US West, cable operators have been overwhelmed with new technology and applications for interactivity.

TCI's suburban Denver test of Viewer's Choice TV (VCTV), while really more a market test than a technology test, nevertheless required a remote control and set-top box manufactured by AT&T, which sends signals over coax and fiber owned by TCI and US West back to the control center. When a viewer selects a film title he wants to watch, the signal activates an alarm in the control center and an attendant manually loads the film into a video tape player and routes it to the proper home.

It's not high-tech, but TCI officials say the process could be automated and supported by digital optical servers–if consumers want the service.

CableLabs advocates following the model of the regional hub architecture

DON RILEY

An attendant at the VCTV center loads a movie into a player

Many other potential providers of an interactive platform to cable operators are already well-known companies, like Scientific-Atlanta, ANTEC Network Systems, Jerrold-General Instrument, United Video and others. But some of the latest comers, like ICTV and Zing, aren't.

The Zing system consists of a handheld remote control with a liquid crystal display that allows viewers to play along with game shows and other programs. The system works by receiving a data stream sent over the vertical blanking interval to a set-top receiver, which in turn sends the data to the handheld unit via infrared.

Zing officials hope set-top convertor manufacturers will build the receiver and IR blaster into their products. The handheld unit will be offered for sale at retail electronics stores. The company may have some clout with the convertor manufacturers because its major financial backers include TCI, Continental, Comcast, Newhouse and Landmark Communications.

There has been some disagreement over the definition of 'interactivity'

Getting more complex

ICTV, on the other hand, offers interactivity through IBM video servers located at the headend, which removes expensive hardware from the home. ICTV, which was demonstrated at the National Show, has been designed to allow operators of one-way cable systems to deploy an interactive system without having an upstream path.

In the headend, a "video Centrex" routing, switching and processing device is used to instantly switch a TV viewer who has tuned into an interactive tier offered by the cable operator to a variety of interactive services. The Centrex establishes a dedicated channel to the viewer and offers video highlights of each service being browsed through until a particular service is selected.

Once the selection is made, the high-speed server takes over to deliver video and graphics associated with the selected service, says Lee Hoarty president of ICTV.

The only hardware required in the home is a convertor "sidecar" which is used to communicate with the headend. ICTV officials also hope to have the technology built into convertors.

One company that has successfully negotiated agreements with major convertor manufacturers is United Video Satellite Group, which is working on an interactive platform. UV has already signed S-A, Jerrold, Pioneer and Zenith on to the project; those companies will soon build ports into their convertors to accommodate a sidecar unit. The sidecar will control consumer access to the interactive programming, according to Jerry Henshaw, senior vice president of science and technology at United Video.

Another participant in the project is Kaleida Labs, a multimedia company created by Apple Computer and IBM. United Video plans to use Kaleida's ScriptX multimedia playback software for future digital set-tops.

Kaleida will also be working closely with Scientific-Atlanta to facilitate interactivity through S-A's new 8600x set-top terminal, it was announced during the National Show (for more information, see the NCTA Show wrap-up, starting on page 42).

United Video is also trying to move operators into interactivity via its more traditional program guide service. The company is already making use of a laser disk-based video file server that offers real-time video clips tied to text.

Clearly, there is experimentation with interactivity at all levels of complexity. But one trend is certain: computing power is becoming more accessible at lower prices. If consumers in places like Orlando and Castro Valley demonstrate a desire for interactivity, cable seems poised to take on the additional business. CED

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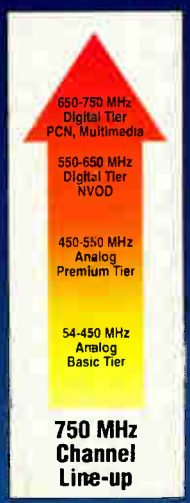

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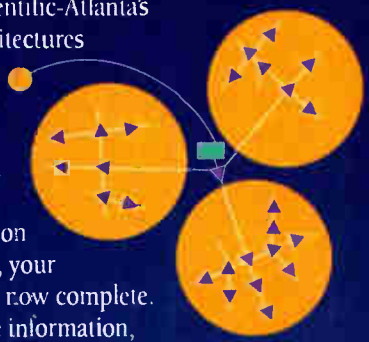

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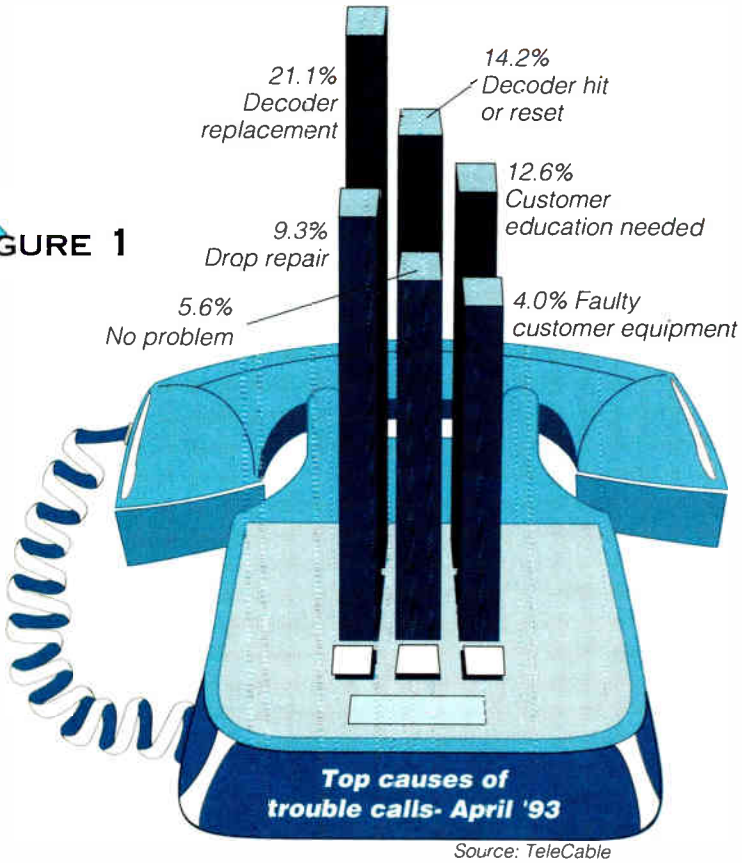
FIGURE 1



Source: TeleCable

Trends in outage reduction

Cable/telco differences

By Leslie Ellis, CED

"Technology goes on improving humanity's view of the reality out there," Isaac Asimov was once quoted as saying. These words have particular impact within the current cable environment, with high-level executives espousing all kinds of not-so-far-off realities like telephone service and interactivity to the nth degree. Attendees at last month's National Show witnessed a plethora of interactive displays, showing happy families shopping for clothes, ordering pizzas and videoconferencing with architects–all courtesy of cable's broadband, digital platform.

However, an undelivered pizza ordered via cable interactivity likely yields a subscriber both irritated and hungry. An improperly or non-routed emergency phone call not delivered because of a cable outage could yield calamity of catastrophic proportions, from a human, financial and legal perspective.

It is these concerns that are forcing a revolutionary shift in thinking about outage reduction. CableLabs, now finished with the the initial work undertaken by its Outage Reduction Task Force, is initiating further study on the topic. TCI is now installing uninterruptible power supplies in all of its networks. Network monitoring systems are enjoying new popularity with cable operators. One cable operator, TeleCable Inc., even went so far as to modify its entire management philosophy last year in an effort to improve reliability and service.

"We're seeing a radical reversal in operator thinking about standby power," says Tom Osterman, president of Comm/Net Systems Inc. "A number of things have come around full-circle from three years ago, like increased standby power, backup power and status monitoring."

Prompted by telephony

The changes, Osterman says, are prompted mostly by talk of cable-delivered telephone services. "A momentary power interruption in a telephone environment would cause any phones that were off-hook to hang up." Because of that, he says, reliability issues quickly surpass subscriber irritation concerns.

It's not coincidental that current telephone service suffers few outages. Paul Shumate, executive director, distribution network technology for Bellcore (the R&D and statistical analysis entity funded by the telephone industry), cites an industrywide telephone network reliability target of 53 unavailable minutes per year, not including catastrophes such as earthquakes or hurricanes. "That translates to 99.99 percent reliability, for both residential and business phone traffic," Shumate says.

Granted, the telephone and cable industries power their respective plants quite differently. Because telcos have no present need to provide video, they currently pass 48 volts of DC (113 volts for T-1 service) through their networks, Shumate says. Cable companies typically power with 60 volts of AC. "The 48 volts are always there; there's battery power flowing through the network at all times. If there's an outage, the batteries simply stop charging," Shumate explains.

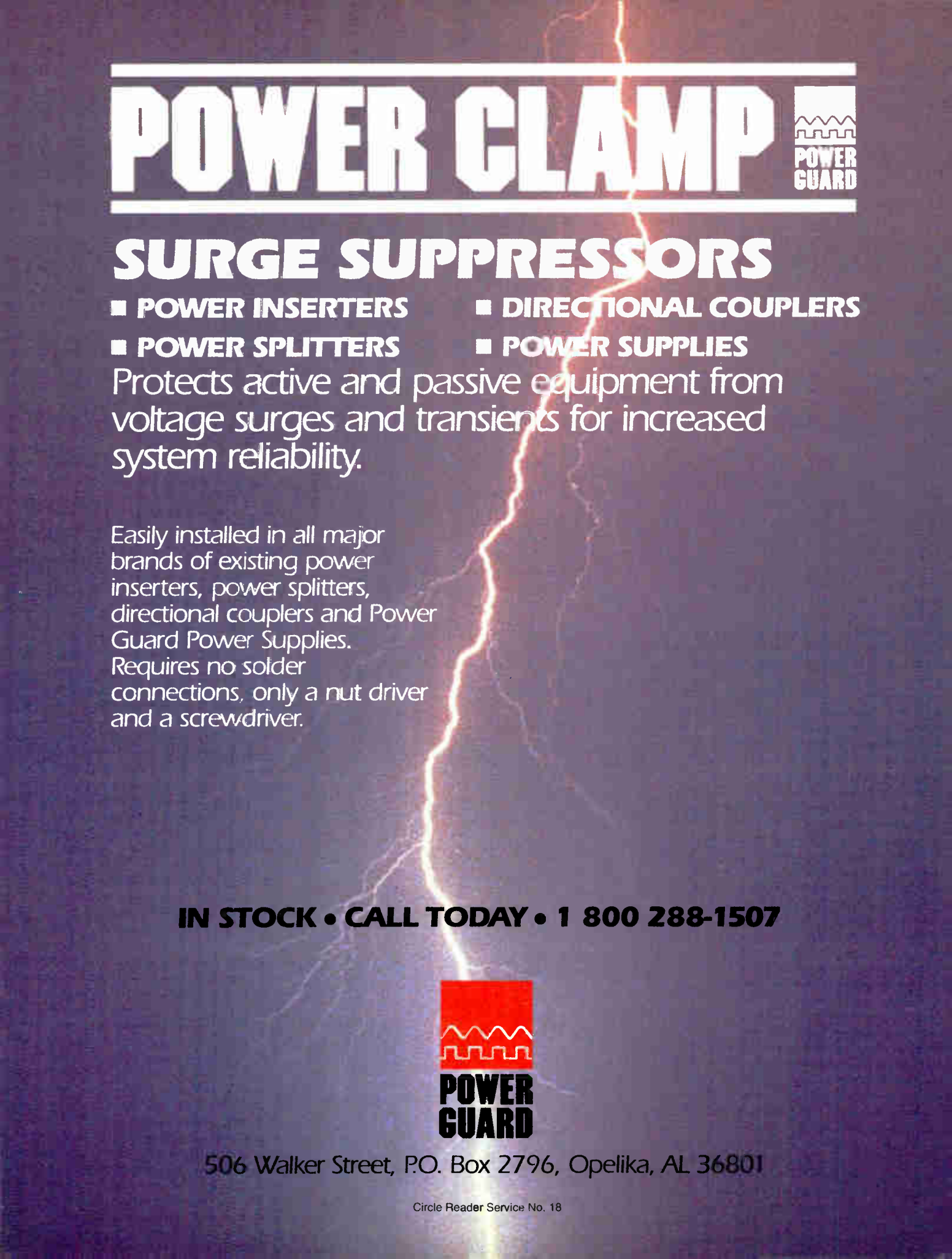
However, Osterman believes this telco approach will slowly change, particularly in light of video delivery. "Initially, the RBOCs are indicating a desire for 60 volt powering systems, that have to be uninterruptable," Osterman says.

Chris Bowick, group VP/technology for Jones Intercable, has a different view of cable/telco outage issues. "The cable industry is 'off-hook' most of the time–many, many hours per day. And therefore, it's a very visible situation when we have an outage," Bowick says. "I mean visible in the very literal sense of the word.

"In a telephony environment, the phone is on the hook most of the time. If there's an outage, nobody even knows until they pick up the phone," Bowick continues.

Operator efforts

However, reliability concerns are not falling on deaf ears among cable operators. Operators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including TCI, Jones Intercable, TeleCable–among many others–are taking innovative stances on the intertwined subjects of reliability, standby power and network monitoring. Individually, they have similar outage targets as telco providers. "Our internal number of unavailable minutes per year is the same–53 minutes, or 99.99 percent reliable," says Bowick. "In fact, our outage reduction efforts are reflected in management bonuses at the system and the corporate level."

Bowick says that increased fiber deployment and a corresponding amplifier cascade reduction has inherently fortified overall cable network reliability. "I don't think we toot our own horns well enough about the amazing impact fiber has had on overall network reliability," Bowick laments.

Trend toward UPS

Jim Haag, director of TCI's test and evaluation department and a member of CableLabs' Outage Reduction Task Force, says the company will put uninterruptible power supplies in all of its systems from now on. "Our network design is very much more passive, thanks to the deployment of fiber. Because of that, it's becoming more cost-effective to put UPS-type devices everywhere."

One cable operator taking a radically different approach to outages–and reliability in general–is Virginia-based TeleCable. As Nicholas Worth, VP of Engineering for TeleCable, explains, the company is currently in the throes of a five-year "continuous improvement" cycle. At the end of the five years, Worth says, the company and all of its systems nationwide will have embraced the Japanese "continuous improvement" concept.

The ultimate goal: highest quality service at a low cost.

"This combination has been deadly for the Japanese–that's why the United States doesn't have a consumer electronics industry, to speak of," Worth says. Instead, TeleCable has chosen to "reduce the expense side of the equation," by eliminating wastefulness, Worth says. "Why should there ever be a trouble call in the first place? These are the kinds of things we're examining." As part of the program, TeleCable is charting the percentage of total trouble calls, by code, and motivating employee teams to find root causes of the problem (see Figure 1).

So far, Worth says, the company is seeing improvement in "thousands of tiny little steps." He cites as an example TeleCable's Cleveland, Tenn. system, which has reduced its trouble calls attributable to installation follow-up work from 150 per month to between 15 and 17 per month.

He says the program isn't for the "quick fix" artist. "Americans use the concept of TQM as a buzzword. In Japan, it's more like a religion," Worth says. "It's a difficult program to implement–you have to break through the inertia of the 'old way' as well as rip down the ivory-tower type of management."

As a part of TeleC able's continuous improvement program, it has asked a power supply vendor to develop a "floating" standby power supply for use in its Broward County, Fla. system. "We're moving toward smaller nodes with UPS types of powering. The one in development is very close to completion. It will use continuously flowing power, and the charge is large enough to replenish the entire load, if necessary."

CableLabs efforts

Meanwhile, CableLabs continues its efforts toward outage reduction. Saying that the task force is at an "in-between stage," having completed four chapters worth of work on the subject, CableLabs' Scott Bachman, VP of operations technologies projects and head of the task force, is hoping to "evolve the outage reduction task force into more of an industrywide outage reduction focus."

"The model we have now is the first step," Bachman says. "Now we need to use it to sort of ratchet the industry up to a higher level of awareness about status monitoring, headend reliability and those sorts of things."

In the next phase of the project, CableLabs will work with billing software providers to implement automatic outage detection and tracking codes into their product lines. Also, CableLabs has commissioned a power consulting firm to provide input on how the cable television industry can better utilize the reliability between the power grid and the cable TV power supply, Bachman says.

CableLabs will also implement a benchmarking project to include national outage statistics, and evolve the outage reduction group into a "network reliability" group, Bachman says. "We have to elevate industry thinking. The next step is network modeling. We need to raise that to a higher level, to boot-strap the industry," Bachman says.

Jones' Bowick agrees with a need for elevated awareness about reliability and outages. "I think we need to improve as an industry. There's no doubt about that," Bowick says. "As we move more and more away from just the delivery of video entertainment, to where we are delivering life-critical types of services, we're going to need to ensure that we've got the same kinds of reliability that the telephone companies calculate that they have–and, in fact, beyond that." CED

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Technology back in the driver's seat

National Show full of glitter

By Roger Brown and Leslie Ellis, CED and Peter Lambert, Multichannel News

Nearly 16,000 registrants–a record–flooded Moscone Convention Center in San Francisco for Cable '93, the 42nd annual NCTA convention and exposition. What brought the record-breaking crowd was a vibrant industry (in spite of the regulatory woes currently being experienced) that is positioning itself as a provider of diverse services over a broadband network and a key player in the national information infrastructure.

Attendees were given glimpses of the future: an interactive environment filled with games, educational programs, communication gateways and new niche channels.

Although the programmers made the most audible noise on the show floor, technology was clearly the driving force behind the expo. The opening general session, titled "Cable Television: America's Highway to Tomorrow," set the tone: "The promise of technology is just beginning to show itself," said Jim Mooney, president of NCTA.

Likewise, the opening panel–consisting of Frank Biondi of Viacom, Jim Clark of Silicon Graphics, Charles Dolan of Cablevision Systems, John Malone of TCI and film director George Lucas–focused on the potential of technology and how it will enable programmers to become interactive with the audience.

"At the very least, technology will improve what we have today," said Dolan.

Malone said the key is the deployment of high-power microprocessor in every home, school and business. "This is the enabler," he said. When asked whether those devices can be affordably deployed, he said: "a universal device with common operating software will drive the cost of the hardware down. The cost of communicating will head toward zero. Access to bitstreams won't be an issue–the question will be what you do with it."

Time Warner selects Silicon Graphics

Time Warner Cable has decided what to do with its bitstream in Orlando. It has selected Silicon Graphics to provide the "final major piece" of the Full Service Network, slated to begin serving customers at the end of the year, it was announced at the Show.

Specifically, Time Warner will deploy two Silicon Graphics "Challenge" video servers to deliver high-speed packets of information from the servers through an ATM switch to 4,000 subscribers' homes. These servers offer "terabyte-level" video storage capabilities and are based on MIPS Technologies Inc.'s RISC-based (Reduced Instruction Set Computing) multimedia architecture.

Silicon Graphics will also supply set-top and network operating systems for the Orlando system. Time Warner has already tapped Scientific-Atlanta to provide fiber distribution gear and set-top terminals for the FSN.

Silicon Graphics will base the software operating system on the MIPS multimedia engine that delivers the necessary power for high-speed communications, interactive thee-dimensional graphics, an on-screen user interface and compression and decompression for video and audio.

"Navigating through all the types of services we plan to offer is a potential challenge to our subscribers," said Time Warner Cable's Senior Vice President of Engineering and Technology Jim Chiddix. "Powerful, three-dimensional interactivity is a key element."

The multimedia engine also provides a flexible platform for software developers to create new applications for interative cable systems, said Jim Clark, chairman and founder of Silicon Graphics. One function that will be made a reality is the "virtual VCR." This feature allows television viewers who have purchase a movie on demand to control it, including remote stop, start and puase features.

Motorola, Kaleida, S-A make team

Another important announcement made during the convention related to a partnership agreement between Motorola Inc., Kaleida Labs Inc. and Scientific-Atlanta to codevelop "open architecture" interactive/multimedia sotware and hardware for cable home terminals. The products apparently would compete with computer-powered terminals planned by General Instrument, Intel Corp. and Microsoft Corp.

However, Kaleida, which is co-owned

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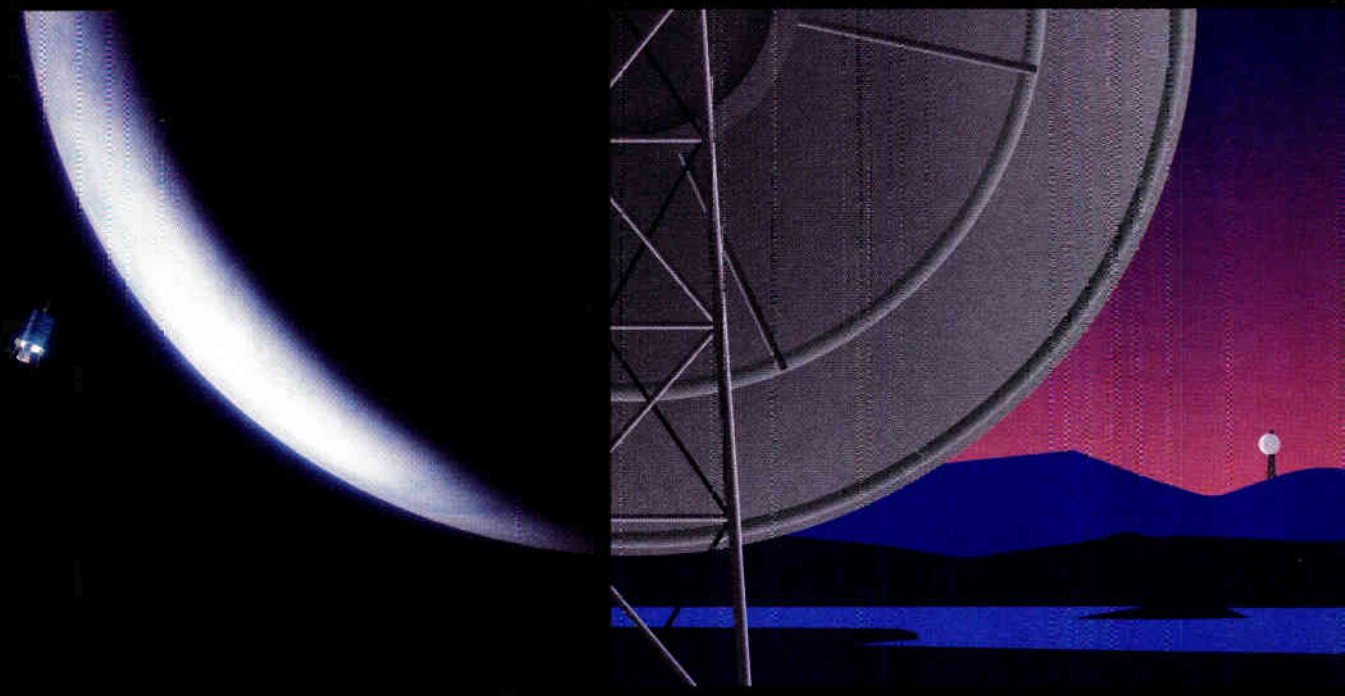

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by Apple Computer Inc. and IBM Corp., seeks to license its interactive multimedia software technology to all hardware and software providers, including Microsoft. Pending a final agreement in mid-July, S-A will develop home terminals, servers and network systems incorporating "device-independent" ScriptX multimedia software technology developed by Kaleida.

Motorola microprocessors will go into the S-A products. Through a two-year-old joint project with Apple and IBM, Motorola has been developing a chipset based on a reduced instruction set (RISC) architecture called PowerPC.

"The PowerPC family of microprocessors from Motorola provide the high-performance, cost-effective solution for our strategy to provide cable operators with a flexible platform," said Gary Trimm, president of the subscriber systems division of S-A's Broadband Communications Group.

Time Warner Cable has tapped S-A and Toshiba to provide home terminal technology for its Full Service Networks.

In late May, Apple, IBM, Hitachi Ltd., Toshiba Corp., Mitsubishi Electric Corp. and Creative Technology Ltd. formed a hardware manufacturers alliance supporting ScriptX.

Kaleida president and CEO Nat Goldhaber said his company is negotiating with other cable equipment makers and hopes to reach ScriptX licensing agreements with all comers. Kaleida has submitted ScriptX specifications to the Interactive Multimedia Association's Scripting Language Request for Technology.

New Products

Advanced Audio Visual Systems

Advanced Audio Visual Systems debuted its the Access 2000, a turnkey system designed to increase buy rates of premium and PPV movie channels and provide an electronic program guide. The system provides a multiplexed image of 13 channels. An optional expansion switcher can display up to 36 channels. Circle Reader Service No. 53.

Alpha Technologies

Alpha Technologies introduced the CableUPS series of uninterruptible power supplies for the cable industry. The product family consists of two units: the XP and FP. The XP features a single ferroresonant design to regulate output voltage, battery backup, surge and short circuit protection and complete line conditioning under different modes of operation and loading. A modular design allows for 12- and 15-amp operation and changeout of inverter and charger electronics. The FP series incorporates compact design and affordable cost, according to Alpha.

Also new from Alpha is its "CFR Series" of ferro-based uninterruptible power supplies. The products have been designed to provide clean, uninterrupted power to critical hardware at the headend or an unattended remote hub site. Circle Reader Service No. 54.

C-COR Electronics

C-Cor Electronics, which celebrated its 40th birthday at the Show, announced its new Flexnet amplifier series. The series consist of both trunk and bridger amplifier offerings. The amplifiers, available at bandwidths of 750 MHz up to 1 GHz, feature PHD technology, active distribution outputs and status monitoring capability. The Flexnet trunk amp features one trunk level output and up to two distribution outputs. C-Cor also demonstrated an active display of its digital fiber RF scrambling system in San Francisco. Circle Reader Service No. 55.

Channell Commercial

Channell Commercial Corp. has introduced the Budget Pedestal Housing Series of inexpensive above-ground enclosures for buried cable television coaxial plant. The new product line will initially consist of two products constructed of high grade flexible polyethylene with preinstalled stakes and brackets. Both products are square in shape. The seven-inch by seven-inch unit is designed for passive electronic equipment while the larger nine-inch by nine-inch unit is suitable for passives and some electronics.

Also new from Channell: its SPH 1320 enclosure, an addition to the company's "Signature" series of pedestal housings. The new pedestal provides an upright design and enough space to house line extenders, trunk amps and/or optical fiber splice cases. The new housing can also be used internationally as a dual coaxial/fiber optic cable pedestal for universal telecommunications applications. Circle Reader Service No. 56.

Channelmatic

Channelmatic Inc. unveiled its new Audio Level Control product at the Show, designed to automatically maintain consistent audio levels on a per-channel/per-network basis. "Use of the ALC's amplifier circuits on multiple channels allows audio levels to remain constant, even when subscribers tune from one channel to another or during transitions between local commercial breaks and network programming," explained Mike Watson, senior VP of marketing and sales for Channelmatic. The unit works by monitoring audio input levels from -24 dBm to +14 dBm and providing a constant output range of -2 dBm to +2 dBm with a total harmonic distortion not exceeding 0.25 percent. Modules for up to 12 stereo channels or 24 monaural channels can be incorporated into a single unit, which will expectedly be priced at $250 per stereo channel or $225 per mono channel. Circle Reader Service No. 57.

Digital Cable Radio

New from Digital Cable Radio is its "Maestro" universal remote, developed by Jerrold/General Instrument. The hand-held remote is designed to control DCR tuners, stereo systems, CD players, convertors, TVs, VCRs, satellite receivers and laser disc players, DCR officials said. In addition to its universal control features, the remote displays information about the current and previous songs played on Digital Cable Radio, via a display on the front of the device. Song information includes channel name and number, song title, artist, CD or album title and record label. It also includes built-in capabilities to display sports scores and financial tickers. Circle Reader Service No. 58.

Electroline

Electroline Equipment Corp. has a new 1-GHz low noise amplifier designed for use in passive coaxial feeder networks now being planned and implemented by cable operators. The company's new "DropAmp" offers a noise figure of 3 dB, while providing 14 dB output and 23 dBmV output per channel. An optional 5 MHz to 30 MHz return is available with the addition of one filter. The amp offers -60 dB composite triple beat, composite second order and cross-mod specs. Circle Reader Service No. 59.

Fotec

Fotec has released a new PC software package, dubbed "FOTest," designed for use with its M300A series fiber optic power meter. The package was designed to simplify testing of fiber optic systems and components and to log or print test results. The software provides a graphic depiction of the power meter and the test setup, and is priced at $50. Circle Reader Service No. 60.

GE American Communications

GE American Communications has announced it will build, launch and operate

Zenith Cable Products' addressable cable decoder with built-in capability to receive and display electronic data services from multiple providers.

a new hybrid satellite called GE-1. The new satellite will service broadcast, cable, education, government and private business. It will be the first satellite to use the GE Astro Space A2100 design. The launch is scheduled for early 1996. A second identical satellite, GE-2, is currently under construction for use as a ground spare. The new hybrid will carry 24 C-band and 24 Ku-band transponders and will provide full CONUS coverage, GE officials said. Circle Reader Service No. 61.

Harmonic Lightwaves

Harmonic Lightwaves announced several new additions to its YAGLink line of optical transmission systems. The new products, which include optical transmitters and receivers, mark the company's strategy to track with the convergence of digital compression, added bandwidth and advanced digital modulation technologies.

Among the new products from Harmonic are its HLT6008 and HLT6010 externally-modulated transmitters, which offer an output power of 8 mW and 10 mW, respectively. Harmonic officials say the new transmitters were designed with special pricing and system packaging arrangements to enable deeper deployment in existing cable topologies.

Also, Harmonic has increased the bandwidth of its YAGLink HLT series transmitters and receivers to 750 MHz, from 550 MHz. The expanded capacity, Harmonic officials said, leverages the external modulation system's power and signal quality deeper into the distribution plant, giving operators additional flexibility in planning network architectures where two-way digital services such as compression, VOD and telephony, are anticipated. The new, 750 MHz transmitters and receivers will be available in the fourth quarter of this year.

In its return path YAGLink product line, Harmonic Lightwaves has added two new transmitters, the RPT 3005 and RPT 3006, both of which were designed to add incremental upstream digital and analog video capacity to enable on-request video service ordering, voice or T-level data services. The upstream path is established with a return path transmitter module that plugs into the company's HLR optical receivers and transmits back to the headend over a separate fiber. The frequencies used match those typically used in the coaxial plant, making the link between the coax and optical return paths transparent and simplifying the network. Circle Reader Service No. 62.

Hewlett-Packard

New software from Hewlett-Packard has been designed for analysis and storage of cable television system measurements. The software provides full measurement configuration, data collection, trend analysis and report generation all without programming. Measurement results from the database that is created can be converted to FCC proof-of-performance reports and plotted in graphical or tabular format. The data can also be exported to spreadsheet and database programs for further analysis. Circle Reader Service No. 63.

Mind Extension Institute

Mind Extension Institute has introduced an ongoing monthly video training series designed to provide hands-on information about a variety of critical issues facing the cable industry. The "Rethinking Cable for the 21st Century" series was developed to offer topical, inexpensive staff training, said ME/I officials.

The series has been designed to stimulate staff interaction so that participants walk away from each video with an action plan," said Connie Buffalo, ME/I director of educational product development. "Each month's videotape offers solutions and ideas about emerging telecommunications issues for the best performers in cable."

The first program, "Cost-effective Customer Service: Sure-fire Tips for Success," will be available this month. Circle Reader Service No. 64.

Ortel

Ortel Corp. announced its 3620 series of 600 MHz and 860 MHz CATV lasers and board assemblies, designed for OEM manufacturers of CATV fiber optic transmission products. The lasers and assemblies feature up to 16 mW of output power, which Ortel VP of New Business Development Larry Stark calls "the highest output power anywhere."

The 16 mW of output power enables signal transmission over longer distances or splitting of lightwave signals into multiple receivers, or both, Stark said. "Such a design would use only passive coaxial ca-

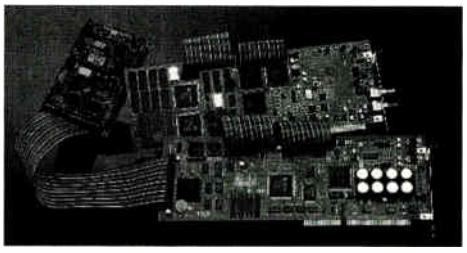
ble, splitters and taps downstream from the optical receiver." The 3620 family of products includes a high performance DFB laser and an RF predistorter board. The latter was designed to maintain laser temperature and bias control when using Ortel-supplied DC circuits. "DFB laser output power is growing at a rate of 2 dB every year," Stark said. "By this time next year, we expect to be producing 25 mW DFB lasers. Circle Reader Service No. 65.

Pioneer Electronic Corp.

Pioneer Electronic Corp. has announced it has developed a set of VLSI chips designed to decompress digital moving image data at 25 Mbps. The chipset is compatible with three international standards and allows for an upgrade path to the emerging MPEG-2 standard. Specifically, the new chip supports MPEG1 (digital moving video), JPEG (digital still video) and CCITT H.261 (video phones and videoconferencing). The chips are expected to be used in cable television, CD-ROM units and other prepackaged media, electronic cameras, video phones and videoconferencing systems. The chips were designed at Pioneer's new Digital Design Centre in the United Kingdom. Circle Reader Service No. 66.

Sadelco

Sadelco introduced two new calibrators: the SC600 (600 MHz capability) and SC1000 (1 GHz capability), designed for the calibration of signal level meters. The units can also be used to check the response of CATV and local area network distribution equipment. Both units are based on Sadelco's patented white noise generator technology, Sadelco officials say, and offer an increased noise output level to +20 dBmV, a precision rotary attenuator, and both horizontal and vertical sync pulse modes of the CW signal. The units also feature switchable 1 kHz modulation. Circle Reader Service No. 67.



Scientific-Atlanta's new MPEG PC Decoder boards.

Scientific-Atlanta

New from Scientific-Atlanta is an "all-in-one" optical receiver which fits into the lid of the company's existing system amplifier II (SA II). The enhancement was added to facilitate fiber-to-the-serving-area (FSA) topologies from the bottom up, SA officials said. The receiver is designed to 1.5 GHz and utilizes the reversible signal flow feature of the SA II amplifier. Further, it provides cable operators with a platform for advanced system monitoring, reverse video and wave division multiplexing applications. Other features include dual cable inputs for RF switching of redundant fiber routes, separate optics and RF sections for simplified maintenance and individual LED displays to alert technicians of any problems during field checks.

Scientific-Atlanta Inc. also unveiled a digital storage and retrieval (DSR) system it says has driven the cost of encoders down by a factor of 10. The $25,000 encoder price will make applications such as digital advertising insertion affordable to local operators, said S-A. Starnet's AdStar has already begun accepting delivery of hardware. The MPEG-based system will be suitable for automated movie on demand systems, said S-A. Circle Reader Service No. 68.

Siecor Corp.

Siecor Corp. announced several new products and enhancements to existing products at the Show. The company's

new CheckPoint Fiber Identifier can identify which fibers are carrying live traffic, a 2 kHz pulsed signal or no signal at all, utilizing a non-destructive macrobend technique that does not interrupt normal service or compromise fiber integrity.

Also, the company's new VFL-200 Visual Fault Locator can be used to visually pinpoint faults during installation, maintenance and production through a visible red glow at a point of high loss. The unit is useful for identifying breaks, tight bends and fiber crimps.

Siecor's Optical Fiber Access Tool has been enhanced to simplify mid-span access of fibers in loose-tube cables. Design modifications make it easier to enter buffer tubes during system upgrades, Siecor officials said.

Finally, Siecor's new modular Fiber Organization System Fiber Distribution Frame allows users to design a flexible fiber optic cable system in a cable headend that expands as a system upgrades. The FDF is a complete, modular system to be used as an interface between outdoor and equipment cables. Circle Reader Service No. 69.

Tektronix

New from Tektronix is its two-channel TDS-320 oscilloscope, designed to include a high-speed sampling technique that ensures an accurate representation of waveforms in real time (up to 100 MHz). The TDS-320, Tek officials say, offers five-times sampling, which it says is twice the rate of other digital sampling scopes. The scope also includes 21 automatic waveform measurements and four acquisition modes. Circle Reader Service No. 70.

DEALS

Ad insert competitors agree

Ad insertion product suppliers Adsystems, Arvis, CCMS, Channelmatic, Compulink and Texscan have announced their intent to develop product interfaces allowing their equipment to interoperate with SkyConnect, a spot delivery system.

Antec

Antec Network Systems will supply Continental Cablevision of Los Angeles with both fiber optic cable and transmission equipment. The gear, including Laser Link II Plus transmitters and Siecor's loose-tube fiber optic cable, will be used to upgrade Continental's Southern California area systems. When completed, the upgrade will encompass over 800 sheath miles of fiber plant.

Also, Antec announced it will provide Laser Link II Plus optical transmitters in conjunction with Harmonic Lightwaves' optical receivers to a municipally-owned cable system in Frankfort, Ky. The Cable Television division of the Frankfort Electric Water Plant Board will use the equipment as part of a "major fiber optic installation program," Antec officials said, that will include five miles of LXE cable with fiber counts from four to 132. The system, established in 1952, services roughly 16,000 subscribers via a master headend which delivers 43 channels to 21 individual nodes; the system will upgrade to 70 channels next month.

In a related announcement at the Show, Wometco and Tele-Communications Inc. have agreed to order Antec Network Systems' Digital Video Codec for delivery of video over cable SONET networks. The agreements were inked in an effort to interconnect systems regionally.

Wometco competitive access subsidiary Access Telecommunications Interconnect has ordered 200 DVC 2020 codecs for its existing AT&T FT-2000 SONET-based platform in Atlanta. Additionally, Tele-Communications Inc. has committed to install several hundred DVC 2020 and FT-2000 in San Francisco and St. Louis.

The DVC 2020 system enables an oper-

ator to encode analog video signals at one headend and delivery compressed signals over self-healing SONET rings to multiple decoders at other headends. The DVC 2020 and FT-2000 deliver two broadcast-quality signals over each 45 Mbps (DS-3) circuit. That translates to up to 96 channels on an OC-48 Lightwave System ring.

Bolivian op picks FTF

Bolivia's Video Cable Universal S.A. has activated the first fiber-to-the-feeder cable system in South America, according to officials of ANTEC Network Systems, which supervised the project. The 12-mile optical system featured four Sumitomo optical transmitters, seven Harmonic Lightwave receivers and eight AT&T splice enclosures as part of a three-phase construction project that promises to provide cable service to 60,000 Bolivian homes. VCU presently offers 34 channels to 1,600 subscribers, but plans call for the system to be expanded to several adjacent cities by the end of this year. In other news, ANTEC Communication Services has announced an agreement with Alpha Technologies to market its CFR series of uninterruptible power supplies for headend and office use. The CFR series features zero transfer time to bridge the gap between power outages or brownouts and standby generator start-up and stabilization. Finally, ANTEC announced that more than 60 cable systems have purchased Optical Transition Nodes, a key element in a network design that extends fiber's reach deeper into any cable plant.

C-Cube, TV/Com deliver MPEG-2

C-Cube Microsystems and TV/Com International put MPEG digital video compression on the fast track during the National Show, exhibiting the first live transmission of 10 multiplexed MPEG-2 signals and one single-channel-per-carrier (SCPC) signal, all simultaneously, on a single satellite transponder.

At the same time, C-Cube started volume delivery of a broadcast-quality decoder using a variation on MPEG-1, in preparation for a fully MPEG-2 chipset due out by the end of the year. Showtime Networks' SMATV satellite distribution and Starnet's Adstar ad insertion are among those employing the 10 Mbps MPEG-1 decoder.

Additionally, Philips Consumer Electronics Co.'s Broadband Division selected C-Cube Microsystems to supply it with MPEG video compression and decompression integrated circuits. Philips said it will incorporate the chips in broadcast systems for business and educational TV markets.

In addition to squeezing 11 MPEG-2 signals into a single, GStar 2 KU-band transponder, C-Cube showed in its booth how its modulation system time division multiplexed transport layer can selectively switch data rates. On a video wall in its booth, TV/Com displayed signals delivered at various bit rates and resolutions. At the low end, it showed a 352 by 240 line picture delivered at 1.14 Mbps. At the higher end, it showed 480 by 480 line pictures at 4.0 and 5.0 Mbps (counting only data devoted to picture and not including error correction), as well as 352 by 480 line pictures delivered at 3.5 Mbps.

All in all, the 10 time-division-multiplexed signals were combined in a 60 Mbps data stream; the SCPC signal, 2 Mbps. The center frequencies of the digitized transmissions were operating within 22 MHz of each other.

TV/Com also announced it has opened an office in the United Kingdom, based on "a high level of interest in our digital compression technology," company officials said.

While the TV/Com demonstration used C-Cube's first working MPEG-2 chip, C-Cube said it has found a way to deliver resolutions as high as CCIR-601 using its CL950 MPEG-1 decoder. C-Cube said the chip has been used for high resolution

compression tests by Scientific-Atlanta, Philips Broadband and Thompson Consumer Electronics (supplier of decoders for Hughes Communications' DirecTv direct broadcast satellite system).

David Taylor, director of marketing for C-Cube, said MPEG-2 will almost certainly displace MPEG 1 for interlace, broadcast distribution applications. However he predicted the 10 Mbps ceiling for the CL950 means that MPEG-1 may continue to live in computer and CD ROM as a cost effective alternative to MPEG 2. C-Cube employs b-frame predictive coding in both its MPEG 1 and MPEG 2 decoders.

Carson buys Brooks

The parent company of Carson Industries has purchased Brooks Products Inc.'s plastics division and the newly merged organization will be named Carson Polyplastics Inc. Carson is a manufacture of plastic below-grade and flush-to-grade boxes and poly-concrete lids for the telecommunications industry.

Cox selects Arrowsmith

Arrowsmith Technologies Inc. announced that Cox Cable Hampton Roads will launch its Integrated Cable Operations Management System later this summer. Cox has agreed to roll out the system after a three-month field test which incorporated 20 service vehicles and generated field service productivity increases in excess of 20 percent. Arrowsmith's ICOM system provides fleet management utilizing GPS-based automatic vehicle location, computer-aided dispatch and an advanced geographical information system.

GI , Channelmatic agree

General Instrument has announced the signing of a letter of intent with ad insertion equipment provider Channelmatic Inc., in which Channelmatic will include GI's DigiCipher II compression technology in its digital ad insertion platform. According to the letter, the two companies will work together to incorporate DigiCipher technology into Channelmatic's next generation of local ad insertion headend units. The agreement will also allow Channelmatic to store digitally compressed advertising for insertion into DigiCipher II-encoded compressed channels or analog channels. Hal Krisbergh, president of Jerrold/General Instrument, said that the agreement represents a key part of GI's proposed end-to-end system. "The need for digitally compressed advertising insertion should come about quickly," Krisbergh said. "This ensures that cable operators will be able to seamlessly insert digitally compressed local ads that are compatible with DigiCipher II compression." Both companies said the agreement could evolve into further collaborative efforts.

Jerrold, TV Answer

Jerrold/General Instrument and TV Answer have announced plans to make TV Answer's interactive services available to cable affiliates through Jerrold's next-generation PC-based converters. As part of the agreement, Jerrold will be able to manufacturer an optional RF return path module for insertion into the new generation of convertors, giving cable operators three options for return paths: cable, phone modem or wireless RF.

TV Answer plans to deliver interactive programming and related services by satellite to cable headends which will pass them down the cable to homes. Subscriber responses sent via RF modules will be carried over IVDS networks operating between 218 MHz and 219 MHz.

Mitsubishi, StarSight

Mitsubishi Electric Corp. and StarSight Telecast (previously InSight Telecast) announced a preliminary agreement to build StarSight's electronic program guide and one-touch VCR programming technology into Mitsubishi-brand TVs and VCRs. The patented StarSight service provides television viewers with a personalized, on-screen guide. CED

Negotiations making progress

Tough compatibility battle softens

What the NCTA wants:

- ✔ Definition of "cable-ready" TVs and VCRs
- ✔A return to MultiPort
- ✔ No ban on scrambling
- ✔ Better television tuners

What the EIA wants:

- ✔ Access to signals "in the clear."
- ✔ A prohibition on scrambling
- ✔ Digital standards

By Roger Brown, CED

While nearly every cable operator in the country has been justifiably preoccupied with must-carry, retransmission consent and rate regulations, an often-overlooked amendment to the 1992 Cable Act could have immense ramifications on the way cable television signals are distributed to viewers. Furthermore, the amendment may cost cable operators millions of dollars.

Right now there is an intense turf battle being fought over compatibility between cable set-top boxes and consumer electronics devices like television and VCRs. The high-stakes war is being fought at the highest levels: it is the subject of a Federal Communications Commission notice of inquiry that by law must be acted upon by October. After a report is issued this fall, rules are scheduled to be in place by next year.

At issue is the fact that descrambling set-top convertors take much of the functionality out of televisions and VCRs, making it impossible to perform such tasks as recording one channel while watching another, recording two programs on different channels (unless someone manually re-tunes the convertor) and other functions that require access to more than one channel at a time.

As a single-channel output device, set-tops make these functions impossible to perform without additional convertors, complicated wiring hook-ups or the addition of other "gadgets" that frankly, confuse most users.

The matter has already generated contentious comments filed on behalf of cable operators, the NCTA, television and VCR manufacturers, the Electronic Industries Association and other interested parties. The comments reflect a high level of frustration regarding the fact there is no quick fix to the conundrum; it is clear the two sides share little common ground and the rhetoric has reached a pinnacle.

For example, in its reply comments, the NCTA says perhaps 90 percent of the problems that cause consumer complaints can be alleviated by installing dual tuner convertors, boxes with timers, etc. In response, EIA writes that the NCTA has attempted to "stand the statute on its head" by suggesting that "Congress misunderstood" the problem. Furthermore, EIA takes NCTA to task for suggesting that "set-top boxes are beneficial to consumers" and for proposing to actually increase the number of set-tops in the market. "It defies reason to think that the use of more boxes with more functions will meet the statutory objective of reducing complexity and cost to the consumer," the EIA writes.

NCTA, in its comments to the Commission, steadfastly justified cable operators' use of scrambling systems to protect their programming. "The rigors of the marketplace–and the uncertainties of the laboratory–have pointed cable int he direction of scrambling as the most valuable of the currently available technologies."

However, NCTA attacked the consumer electronics manufacturers to using poorly shielded tuners that are susceptible to direct pickup without a convertor placed between it and the incoming cable as well as that industry's use of the terms "cable ready" and "cable compatible."

NCTA also recommended that consumer products be conspicuously labeled to show how many channels the device tunes so that the persons purchasing the devices readily understand the capabilities of the tuner.

Yet, despite all the barbs being thrown, a joint task force made up of representatives of the NCTA and EIA is reportedly beginning to make some progress. During last month's National Cable Show in San Francisco, a panel billed as a "compatibility debate" came off as a conciliatory discussion between Dr. Walt Ciciora of Time Warner Cable, Gary Shapiro of EIA, Bruce Huber of Zenith Electronics, David Rozelle of Intermedia Partners and Wendell Bailey of NCTA.

Each panelist began his opening remarks with statements of optimism that some logical compromise would be hammered out. It took nearly an hour before the debate actually broke out. But when it did, all the familiar themes were still there.

What EIA wants

When it all gets boiled down, the EIA wants cable operators to provide an unscrambled broadband stream of signals to the back of the television or VCR so those devices can tune the full spectrum of channels offered by the local cable operator.

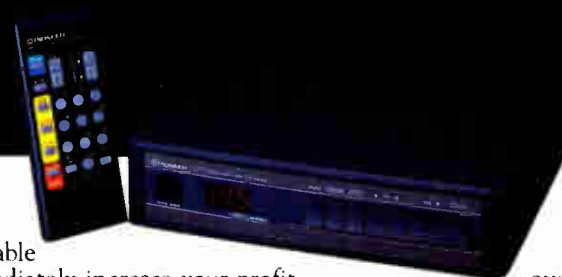
Shapiro said consumers want products that are simple to operate when removed from the box–and they don't get that when TVs and VCRs are hooked up to cable. "Our industry is very tired of the joke about the blinking clock on the VCR," said Shapiro, referring to consumers' inability to program their VCRs.

Huber, who was representing the Consumer Electronics Caucus, agreed that the FCC's first priority should be to allow the use of all the features offered in consumer gear. He placed most of the burden squarely on the cable operators because the installed base of nearly 300 million TVs and VCRs make it impossible for those manufacturers to retrofit those devices. Then he called for standards to address the long-term. "We have to decide who pays the bill," Huber said. "That's the underlying current" in all the comments filed with the FCC.

As a trade-off and an incentive, the EIA is proposing that the FCC allow cable operators to charge viewers more for signals offered in the clear (through interdiction or perhaps broadband descrambling, when it becomes commercially viable). However, Rozzelle said he doubts the FCC will look upon that idea favorably, considering that rate issues were at the heart of the Cable Act.

Ciciora said he believes the solution lies within technology that will soon be deployed by cable operators. A future

FOR CABLE OPERATORS WHO LIKE TO MAKE SOME MONEY NOW AND THEN.



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filled with convertors sporting microprocessor power will have the intelligence to overcome the incompatibility, Ciciora promised. "In a few years, it will be seamless and easy."

As for installing the descrambling and access control functions directly into the TV, Rozelle said he approaches that idea "with deep suspicion" because of the threat of undetectable piracy if the control codes are ever defeated on a widespread basis.

What the NCTA wants

In many minds, the only solution left is deployment of an interface device similar in form and function to MultiPort, which was developed by the joint EIA/NCTA Engineering Committee several years ago. That device performed the descrambling functions amd returned nearly all TV and VCR functions to the respective devices.

Millions were installed in various brands of TVs, but the project died out of a lack of support from cable operators who wanted to retain the revenue derived from remote control rentals.

Obviously, MultiPort (or EIA 563 decoder interface) would need an overhaul to make it work in a digital environment, but NCTA and many cable operators favor the approach because it allows them to continue scrambling to protect their programs.

EIA, however, has steadfastly resisted the idea of resurrecting the interface, calling the technology obsolete and expensive. Clearly, that industry is still smarting over what it saw as a unilateral effort to clear up the problem.

There is precious little time to arrive at a consensus over compatibility

Although time constraints didn't allow other issues to be presented, cable operators also say convertors are often necessary to shield poor television tuners from direct pickup of off-air signals. Furthermore, operators would like a definition of the term "cable-ready," no restriction on scrambling practices and no requirement to deploy interdiction (considered too expensive in some cases) or broadband descrambling (no product yet).

Why so optimistic?

Why, then, did each panelist at the convention profess such optimism? Ciciora said he thought progress was being made at the bargaining table regarding the interface decoder and digital standards, with both sides willing to give a little.

"I have been greatly encouraged by the (actions) over the last couple of weeks," Bailey told the audience. He said he recently argued the merits of digital standards with the NCTA Board of Directors. "I left that meeting feeling strongly a release of tension."

Indeed, the FCC has a history of yielding to compromise solutions hammered out by the affected industries. But the Commission has to recognize that this amendment was written with frustrated viewers in mind–not the EIA or NCTA.

Perhaps the best news out of the latest round of talks is that there is consensus that additional consumer education is needed. Ciciora, for one, believes that if consumers are properly educated about possible solutions to the interface conundrum that many will be able to enjoy most of the features they've paid for.

Furthermore, there is precious little time to arrive at a consensus. Although the Commission has until October to report its findings to Congress, most of the work has to be completed before the August recess, said one FCC staffer. CED

Ad Index

PMD: Answering the questions

Causes and effects of PMD

By Leslie Ellis, CED

Almost two years ago, engineers at a Jones system in Tampa, Fla. experienced a puzzling phenomenon during an installation of singlemode AM fiber. The problem, as Ken Hisle, system engineering manager at Jones recalls, was nothing short of peculiar: time-varying composite second order distortions swings of ± 30 dB (from nominal) over random time spans. The Jones incident was followed by a brief flurry of similar cases in cable systems across the nation.

Cable engineers, curious and befuddled by the random distortions, began querying AT&T engineers, who scurried back to their N.J.-based laboratories to isolate the problem.

The culprit was a rare and quirky fiber affliction identified as PMD, or polarization mode dispersion. However, while AT&T engineers are quick to recognize the fiber malady (and cable engineers whose systems were affected are just as quick to commend AT&T's efforts to resolve the problem), they also stress that PMD is not the sole cause of the odd second order problems witnessed by Jones, TCI and other cable operators. Rather, they stress that PMD and other factors including laser chirp, polarization-dependent loss (introduced by optical couplers, optical isolators and some faulty splices) and other isolated variables all blend to create the time-varying second order distortions. In fact, some systems which mistakenly thought they were suffering from PMD in actuality found faulty optical couplers and over-driven lasers as the reason for their second-order problems.

"If there was no such thing as DFB laser chirp, the dispersion effects found in singlemode fibers would not be an issue–the time-varying second order distortions wouldn't exist," says one cable engineer familiar with the problem. "The two most definitely go together."

Cable engineers and AT&T officials both agree that PMD is not currently a problem with singlemode optical fibers–in fact, AT&T recently issued a specification to characterize maximum PMD thresholds for all current and forthcoming fiber products. "At one time, we saw time-varying second order problems on about 60 percent of our systems," says Richard Rexroat, VP of engineering for TCI. "It's all been corrected now."

What is PMD?

Polarization mode dispersion is as slippery to define as it is to identify and correct, it seems. Briefly put, PMD is a time delay of the propagating modes of light traveling along an optical fiber, caused by a property of optical fibers called "birefringence." Birefringence, in turn, stems from both intrinsic and extrinsic causes. The intrinsic causes–fiber core geometry and internal fiber stress–happen at the manufacturing level. Extrinsic causes such as radial pressure (when fibers rest against each other in a cable), bending and torsion, happen after the fiber is manufactured, usually during packaging of the optical fibers or during field installation.

The effect? "PMD, like chromatic dispersion, can restrict the bandwidth of an optical fiber by spreading pulses in digital systems, and distorting video waveforms in analog AM systems," AT&T officials stated in a recent press release related to PMD.

Clearly, PMD cannot be adequately defined without first reviewing the basics of singlemode fiber optic cable design. Despite its name, singlemode fiber actually consists of two, orthogonally polarized modes. These two modes can be visualized as light vibrations propagating forward, at right angles to each other, along an x- and y-axis, says Jim Refi, distinguished member of technical staff for AT&T.

In a perfect world–if the fiber is "perfect in its geometry (circular) and is perfectly straight, with perfect optical properties in the x and y directions," Refi describes–then the speed at which light propagates through the fiber on the x-axis is the same as the speed at which it propagates on the y-axis. In optical terms, the indices of refraction on the x and y modes are identical; both modes propagate at the same velocity, arrive at the same time and the signal is in the proper polarization state when it reaches the optical receiver.

However, the world isn't perfect. When differences occur in the refractive indices of the two propagating modes (a property referred to as "birefringence"), a delay is introduced. This delay, measured in picoseconds (millionths of a millionth of a second), is what causes PMD.

"PMD is a time phenomenon," Refi explains, "caused when the effective index of refraction in the x-direction differs from the effective index of refraction in the y-direction. When we talk about PMD, we're talking about a difference in the arrival times between the polarizations on the two axes."

Intrinsic causes of birefringence

Geometry discussions relevant to PMD usually focus on the overall circularity (or non-circularity) of the fiber's core. An elliptical, or oval-shaped core effectively lengthens one of the polarization modes within the fiber. Light vibrating along the lengthened (major) axis, then, has farther to propagate and hence travels at a slower speed than the light on the shorter (minor) axis. "Core ellipticity can certainly have a significant effect on PMD," Refi says.

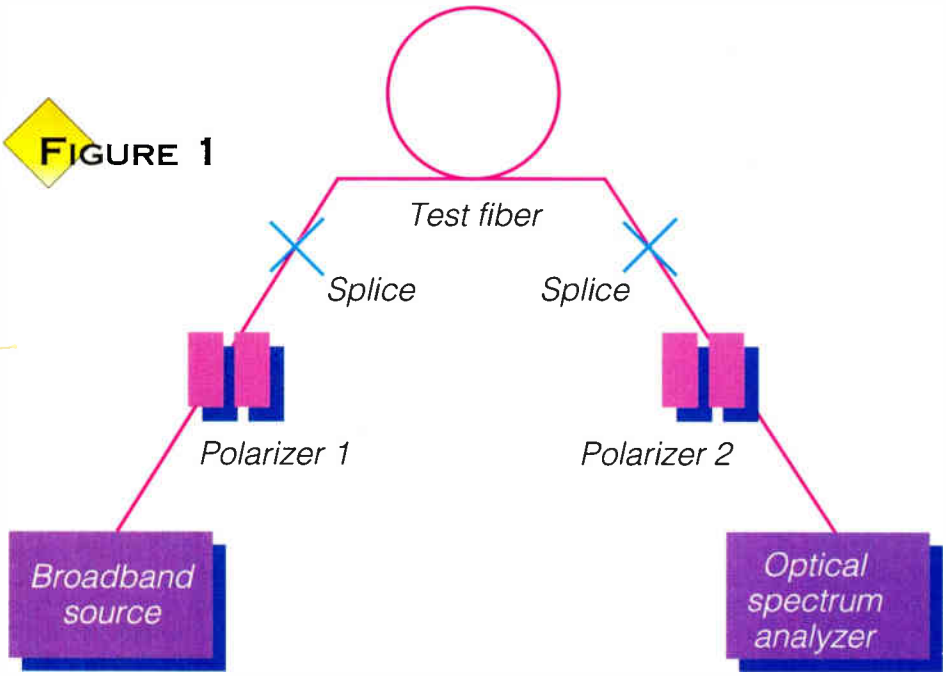
Fiber core ellipticity has long been suspected as a major contributor to PMD, particularly by Corning Inc. officials–whose optical fiber products reportedly offer a highly circular core and cladding, and as such have negligible PMD properties. "One of the frustrations we have at Corning is that we have yet to discover for ourselves any field issues with our fiber. So instead we've focused our efforts on understanding other variations that cause time-varying second-order distortions, like laser chirp and polarization dependent losses," says Doug Wolfe, senior applications engineer for Corning Inc.

AT&T, for its part, does not deny fiber geometry is a contributor to PMD. "AT&T's polarization maintaining fiber has a circular core, but relies on an elliptical cladding to induce the internal stresses needed to change the index of refraction along each axis," Refi said in an NCTA Show technical session on distortions last month.

What AT&T does dispute, Refi says, is the ability to reliably predict PMD solely on the basis of geometry. "Because the PMD level of singlemode fibers relates to a delicate interplay between geometry, external forces and internal stresses, the PMD of a fiber can't be predicted from a knowledge of only one causal contributor," Refi says. Other contributors include polarization mode coupling along the fiber, varying fiber lengths, and the imprecision of measuring small core ovalities, Refi explains.

A second intrinsic cause of birefrin-

FIGURE 1



PMD testing: Using the frequency domain Wavelength scanning method

By Bill Gardner, consultant member of technical staff, AT&T Bell Laboratories

Several methods for measuring polarization mode dispersion (PMD) are utilized in the half-dozen or so commercial instruments now on the market. Although the various methods differ in their details, most measure the change in the output state of polarization (SOP) as the wavelength of the source changes.

PMD defined

Since polarization mode dispersion is a difference in the velocity with which the two states of polarization travel through a fiber, why not measure the time delay difference between two pulses of different polarization?

This time domain approach has been successful for may years in measuring intermodal dispersion in multimode fibers. Polarization mode dispersion is much weaker than intermodal dispersion, however.

The differential delays are on the order of a picosecond rather than a nanosecond, and hence exceed the limits of pulsed lasers and high-speed electronics.(A picosecond actually represents a millionth of a millionth of a second.)

When events become too fast to measure in the time domain, a solution can sometimes be found in the frequency domain. This is indeed the case with polarization mode dispersion.This article, then, will focus on the use of the frequency domain to isolate and measure polarization mode dispersion in single-mode fiber.

In a non-PMD environment

If there were no polarization mode dispersion, the state of polarization would remain unchanged as light travels through a fiber. With PMD, the state of polarization constantly changes as the light travels, and the change depends on the wavelength of the light. If the input state of polarization is fixed, the output state of polarization will vary as the source wavelength is changed.

The larger the polarization mode dispersion, the more the variation will be. This then provides a means of measuring PMD that requires no pulses or high-speed electronics.

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The larger the polarization mode dispersion, the more the variation will be. This then provides a means of measuring PMD that requires no pulses or high-speed electronics.

Although there are several ways of implementing this idea, the Telecommunications Industry Association (TIA) currently has the version shown in Figure 1 under consideration.

Test advantage: simplicity

Although this test method has been given the designation FOTP-113 (for Fiber Optic Test Procedure number 113), it has not yet been approved by TIA, and hence does not have the status of a standard. The test procedure described within this article has the advantage of simplicity: it is basically a fiber spectral loss set with two polarizers added (see Figure 1).

The broadband source generates light over a wide wavelength range (1300 nm to 1650 nm, for example). With both of the polarizers fixed in orientation, the optical spectrum analyzer measures a power $P_2(\lambda)$ passing through Polarizer 2 as a function of the source wavelength. With Polarizer 2 removed from the beam, this power becomes $P_{TOT}(\lambda)$. A sample plot of the ratio:

$$R(\lambda)=P_2(\lambda)/P_{TOT}(\lambda)$$

is shown in Figure 2. The orientation of the two polarizers is generally not important.

Polarizer purposes

The purpose of Polarizer 2 is to convert difficult-to-measure state of polarization (SOP) changes into easy-to-measure changes in the power $P_2(\lambda)$. Dividing $P_2(\lambda)$ by $P_{TOT}(\lambda)$ will eliminate any spectral effects arising in the source or detector.

The oscillations in $R(\lambda)$ will then be a measure of how rapidly the SOP emerging from the fiber changes with wavelength. This effect is illustrated in Figure 2 (next page).

This rate of change of SOP with wavelength is proportional to the fiber's polarization mode dispersion. If $R(\lambda)$ has "N" maxima (or minima) over the wavelength from λ_1 to λ_2, then:

$$PMD = \frac{kN\lambda_1\lambda_2}{(\lambda_2-\lambda_1)c}$$

where:
c = the speed of light
k = a mode coupling factor which

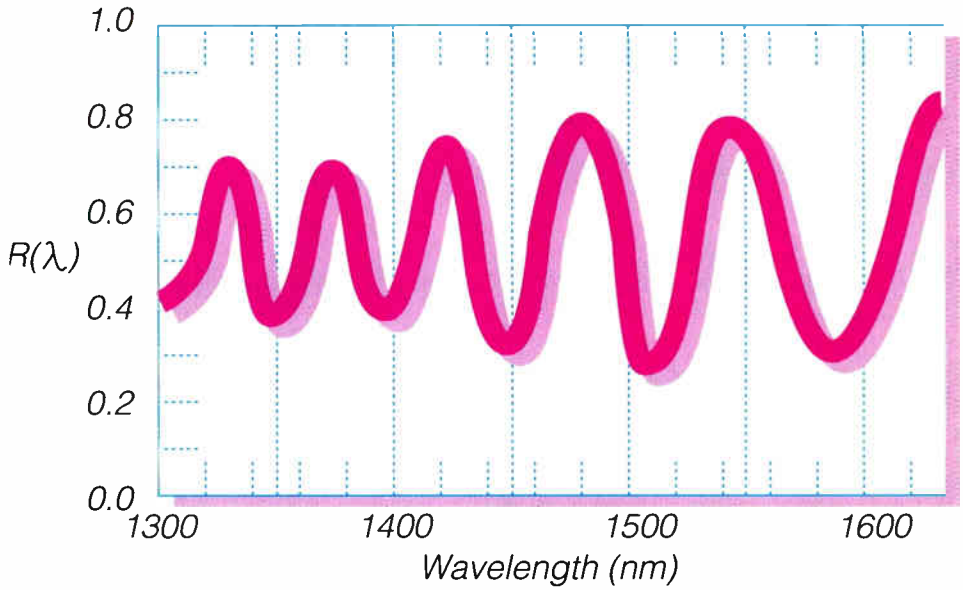
The state of polarization emerging from the fiber is sensitive to the fiber configuration

equals 1.0 in the absence of any coupling between polarizations.

As polarization coupling increases, "k" decreases; the value for strong coupling is about 0.8.

Note from the above formula that PMD has units of time; picoseconds (10^{-12}) is a convenient unit. This time represents the delay difference between the two polarization states for this particular fiber.

FIGURE 2



Coupling effects

If there is no polarization coupling in the fiber, this PMD value can be divided by the fiber length to get the PMD coefficient in ps/km. If there is a strong coupling (which is generally the case for any fiber longer than a few hundred meters), the polarization mode dispersion can be divided by the square root of the fiber length to get the PMD coefficient in ps/√km.

The polarization mode dispersion measured in this way is really the time delay difference averaged over the wavelength range λ_1 to λ_2.

This average has generally not been found to have a strong wavelength dependence.

Any wavelength dependence in the time delay difference would be affected by polarization coupling, which means that it would vary with time and temperature.

Thus, some averaging over either wavelength or time improves measurement repeatability, and probably does not cause any useful information to be lost. The state of polarization emerging from the fiber is sensitive to the fiber configuration.

The positions of the peaks and to some extent the appearance of the pattern in Figure 2 can be changed by rearranging the coils of the test fiber.

However, the measured polarization mode dispersion is determined not by the positions of individual peaks, but by the density of peaks (N over a given λ_2–λ_1 range), which is much less affected by rearranging the fiber coils.

Broadband sources

The "broadband source" in Figure 1 could in fact be a narrowband source that is tunable over a broad range. Wavelength selection could also be achieved by a monochromator, instead of an optical spectrum analyzer.

All N peaks can be resolved only if there is adequate spectral resolution $\Delta\lambda$, which is the instrumental spectral width, or the wavelength step size, whichever is larger.

For λ in the vicinity of 1550 nm, a rule of thumb is that $\Delta\lambda$(nm) should be less than the reciprocal of the largest PMD (in picoseconds) that must be measured.

The best accuracy is obtained by making (λ_2–λ_1) large enough to insure that N is considerably greater than λ. Values of N in the range of three to 20 are typical.

Percentage uncertainties

When N is at the low end of this range, the percentage uncertainties in both N and polarization mode dispersion (because of a ±1 uncertainty in N) become large. At the upper end of the range, instrumental broadening may result in some adjacent peaks not being resolved.

This test method has been submitted to the TIA for standards consideration

The lowest values of polarization mode dispersion that could be measured by this technique can be calculated by minimizing the numerator and maximizing the denominator in the polarization mode dispersion formula.

The formula gives a minimum polarization mode dispersion equal to 0.016 picoseconds by setting:

N=1
k= 0.8
λ_1=1300 nm
λ_2=1650 nm and
c=300μm/psec

The largest value that could be measured is determined by the test set's spectral resolution $\Delta\lambda$.

If this is 0.1 nm, then the rule of thumb above says that the largest PMD measurable at 1550 nm is approximately:

$(0.1)^{-1}$ = 10 psec.

These upper and lower limits for this particular method cover most cases of practical interest.

Extrema identification

In the presence of noise and/or strong mode coupling, the identification of extrema in R(λ) may be more difficult in the example of Figure 2.

An algorithm with the following features is useful in identifying extrema:

1. A polynomial is fit to several (roughly 16) adjacent points of R(λ) to provide a smoothed curve.

2. An extremum is defined as a point where the wavelength derivative of this smoothed curve changes sign.

This type of algorithm makes possible the automation of the measurement. CED

CED 93 Proc

RULE
76.605(a)(2) Aural carrier center frequency
76.605(a)(3) Minimum visual carrier level
76.605(a)(4) Visual carrier level 24 hour variation
76.605(a)(4)(i) Maximum visual signal level of adjacent channel
76.605(a)(4)(ii) Minimum/maximum bandwidth visual carrier level
76.605(a)(4)(iii) Maximum visual carrier level
76.605(a)(5) Aural carrier level
76.605(a)(6) Amplitude characteristic of a single CATV channel
76.605(a)(7)(i) Carrier to noise (C/N) 76.605(a)(7)(ii) Carrier to noise (C/N) 76.605(a)(7)(iii) Carrier to noise (C/N)
76.605(a)(8)(i) Visual signal-to-coherent beats
76.605(a)(9)(i)(ii) Terminal isolation
76.605(a)(10) Hum
76.605(a)(11)(i) Chrominance–luminance delay
76.605(a)(11)(ii) Differential gain
76.605(a)(11)(iii) Differential phase
76.605(a)(12) RF signal leakage

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CATV

Proof of Performance Standards

1993 is the first time since 1985 that American cable television systems are required to meet specific, federally enforced, technical standards of performance. The requirements were negotiated by the cable television industry in conjunction with several organizations representing the nation's franchise authorities, then established as law by the Federal Communications Commission.

These proof of performance standards have become the important benchmarks by which American cable systems are now judged. This chart illustrates, in one all-encompassing table, each standard, the number of channels upon which each test must be performed, how often each test is to be conducted and the type of equipment needed to do the test. It provides a convenient reference for professional technicians to achieve and maintain compliance with the standards.

The National Cable Television Institute, CED magazine and its advertisers are pleased to provide this chart as a focal point of excellence in performance throughout 1993 and beyond.

Cable T
of of Perform

STANDARD	NUMBER OF CHAN
4.5 MHz ± 5 kHz at subscriber terminal and output of modulating or processing equipment	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/301-400 MHz; 8 channels/401-500 MHz
0 dBmV at subscriber terminal 3.0 dBmV at end of 100' drop cable connected to tap	All NTSC or similar video ch
Not to vary more than 8 dB within any six month interval (measured before the converter)	All NTSC or similar video ch
Within 3.0 dB of any visual carrier within 6 MHz	All NTSC or similar video ch
Within 10 dB of the visual signal level on any other channel on a cable system of up to 300 MHz. A 1 dB increase in level separation for each additional 100 MHz of bandwidth: 11dB for a 400 MHz, 12 dB for 500 MHz, 13 dB for 600 MHz.	All NTSC or similar video ch
A maximum level that will not overload the subscriber's receiver or terminal.	All NTSC or similar video ch
10 dB–17 dB below the associated visual signal level. Baseband converter: 6.5 dB-17 dB below the associated visual signal level.	All NTSC or similar video ch
± 2 dB from 0.75 MHz to 5.0 MHz at tap and before converter (prior to Dec. 30, 1999) above lower boundary frequency of CATV channel (referenced to average of highest and lowest amplitudes)	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/301-400 MHz; 8 channels/401-500 MHz
Carrier to noise shall not be less than: 1) 36 dB (June 30, 1992-June 30, 1993) 2) 40 dB (June 30, 1993-June 30, 1995) 3) 43 dB (As of July 1, 1995)	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/301-400 MHz; 8 channels/401-500 MHz
Not less than 51 dB for non-coherent (standard) CATV systems (modulated carriers and time-averaged) Not less than 47 dB for coherent (HRC/IRC) CATV systems (modulated carriers and time-averaged)	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/300-400 MHz; 8 channels/401-500 MHz
Not less than 18 dB (manufacturer's specifications) and sufficient to prevent subscriber-caused terminal reflections	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/301-400 MHz; 8 channels/401-500 MHz
Not to exceed 3% of visual signal level	Only on a single channel wit unmodulated carrier
Within 170 ns	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/301-400 MHz; 8 channels/401-500 MHz
Not to exceed ± 20%	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/301-400 MHz; 8 channels/401-500 MHz
Not to exceed ± 10 degrees	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/301-400 MHz; 8 channels/401-500 MHz
< 54 MHZ = 15 mV/m @ 30 m 54-216 MHz = 20 mV/m @ 3 m > 216 MHz = 15 mV/m @ 30 m	4 channels minimum, +1 cha 100 MHz or fractional increa 5 channels/101-216 MHz; 6 channels/217-300 MHz; 7 channels/301-400 MHz; 8 channels/401-500 MHz

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NELS	FREQUENCY OF TESTING	TYPE
annel every se:	2 x year	Spectr or auto
annels	2 x year	SLM, s or auto
annels	In July or August and January or February, 1 test each channel every 6 hours for each 24 hour test.	SLM, s or auto
annels	In July or August and January or February, 1 test each channel every 6 hours for each 24 hour test.	SLM, s or auto
annels	In July or August and January or February, 1 test each channel every 6 hours for each 24 hour test.	SLM, s or auto
annels	2 x year	SLM, s or auto
annels	2 x year	SLM, s or auto
annel every se:	2 x year	Sweep or aut
annel every se:	2 x year	SLM or a
annel every se:	2 x year	Systen or auto
annel every se:	2 x year	Manufa
h a single	2 x year	SLM, s or auto
annel every se:	1 x every 3 years	Vectors or auto
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annel every se:	2 x year	SLM, s analyz strengt

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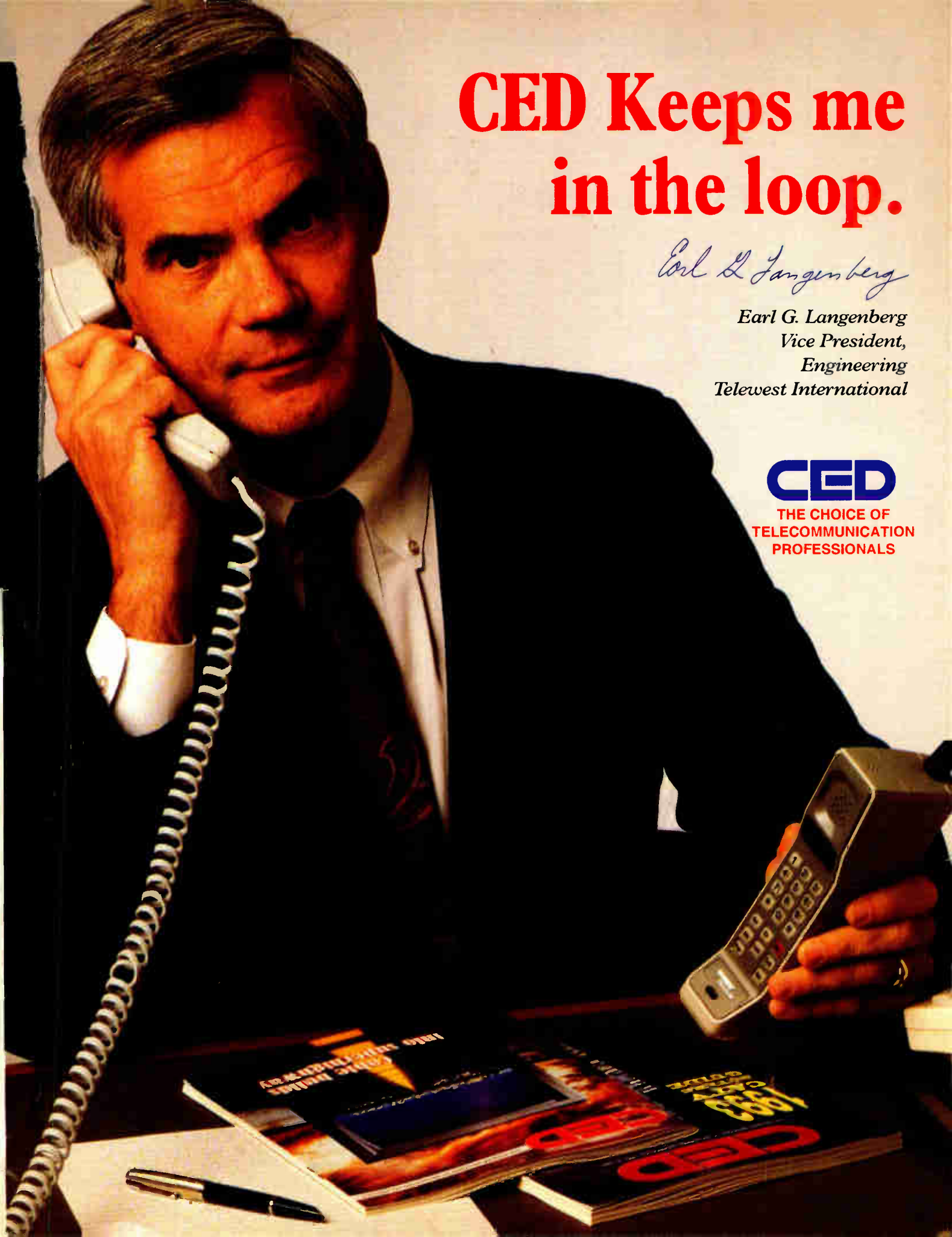
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FIGURE 1
Lost opportunity revenue

Signal security management

A team approach

By Philip Cochetti,
Area Security Manager,
Comcast Cablevision of Philadelphia

Philadelphia, a city of 1.6 million people, was originally serviced by four separate cable franchises. Comcast Cablevision of Philadelphia was one of the franchises and it eventually acquired another. These two franchises encompass half the city, serving a subscriber base of approximately 155,000. while passing 329,000 homes on a 1,400-mile cable system. These statistics translate to a densely populated urban community consisting primarily of row homes, neighborhood businesses and multi-family dwellings.

After the acquisition, Comcast converted to a 100 percent Jerrold addressable system. This advanced technology was originally thought to be the answer to unauthorized reception problems. Although addressable convertors have enhanced customer service and minimized truck rolls, they are a security nightmare. The "underground" has produced counterfeit erasable programmable chips and acquired illegal equipment ("pancakes") which defeat addressability by replacing it. Therefore, the control of the signal is in the home of the perpetrator, making it much more difficult to prove illegal reception of signal and retrieve evidence for prosecution.

Recent estimates by the National Cable Television Association's Office of Cable Signal Theft conservatively place the loss of revenue at $4.7 billion per year. That is almost 20 percent of annual gross industry revenues.

Comcast management realized a problem of this magnitude justified a security department with a full-time manager. The capture of this potential "lost opportunity" revenue became a high-priority goal.

Program objectives

Senior management recognized the necessity of a team approach to the security problem. Realizing that the "whole is always greater than the sum of its parts," Comcast formed an interdepartmental team of representatives from human resources, marketing, sales, customer service, engineering and security. Each member contributed to the team a different point of view and separate resources. Each shared the responsibility of setting realistic goals for capturing lost revenue because of oversights in company procedure and theft of service.

The team generated the following objectives for the fledgling security department:

✔ Focus on changing employee and customer attitudes about cable theft.
✔ Plan for a long-term commitment, allowing time for development of the security program.
✔ Include the security manager in strategic management for the entire system.
✔ Emphasize pre-hire screening and employee training.
✔ Select a manager will full program responsibility.
✔ Include the security department on the interdepartmental team.

Strategies for success

Senior management decided that effective and productive cable systems in the 21st century will include security in all planning discussions. Security must assume the same level of importance as every other major department. Simply put, the security function is the means by which the senior manager can provide the greatest protection of assets and resources for the least investment. Security is regarded as a necessary component that contributes to the effectiveness, quality and profitability of the cable system. This may be the first time security has been viewed as a revenue-generating department. It is considered part of the *business* process and sold from the top of the organization down. In short, security is becoming a business center within the organization concerned with cost and profit.

An important benefit of the security and cable partnership and the ownership of the security program by senior management is that every employee becomes a security representative. Each person accepts some responsibility for security in his or her own area.

An important benefit of the partnership is that everyone becomes a security representative.

Implementation

The security manager is responsible for minimizing risk, maximizing effectiveness, and optimizing human and capital resources.

Internal campaign. The team analysis of internal vulnerabilities yielded the following needs:

✔ Clear procedures for customers reporting suspected cable theft.
✔ Training for personnel responding to customers reporting cable theft.
✔ A written "theft of service" policy to communicate to all employees and subcontractors.
✔ Analysis of the integrity of the subscriber database software.
✔ A test tap audit of multi-dwelling units.

External campaign. The team also formulated an external theft of service campaign. The strategy was to develop high profile publicity for the Comcast security program by prosecuting in federal court a significant population of subscribers stealing service.

The external campaign consisted of the following:
✔ Implementing countermeasures to disable illegal equipment and leverage subscribers.
✔ Conducting electronic "channel swap" countermeasures.
✔ Performing undercover investigations of commercial establishments pirating pay-per-view programming.
✔ Making unscheduled residential service calls, swapping convertors, creating a proper chain of evidence, prosecuting customers when appropriate and publicizing resulting theft of service lawsuits.

Results of internal campaigns

By implementing a theft of service policy, CSR in-service training, employee awareness and "award" programs, Comcast has documented 1,104 cases of unauthorized or illegal cable service to the pirates' homes or businesses.

Since the adoption of the written theft of service policy, clearer directions have been communicated to the staff, resulting in less reliance on individual interpretation. As a consequence of the new procedures, employee morale has improved. Employees are noticing and reporting potential problems that previously would have gone unchecked.

Database integrity: Vacation rate. Comcast offers a vacation rate to subscribers who go on extended vacations. It reduces the monthly charge for basic service from $25.99 to $5. During this period, the customer receives only "barker" screens. The policy was formulated by the Comcast organization whose primary focus is on customer satisfaction. However, because there were no security measures in place, it has been abused.

The security team reviewed all subscribers on vacation rate. Of 295 subscribers, 168 were identified as blatant abusers. They were contacted by customer service supervisors and their upgrades resulted in increased revenue of $32,590 per year.

Database integrity: Commercial accounts. We reviewed all commercial accounts and discovered that the CableData software automatically identified all second outlets as residential rather than commercial. This software error resulted in commercial establishments with secondary outlets receiving both commercial and residential programming.

Of 491 commercial accounts, 224 were receiving unauthorized residential programming. This investigation into "lost opportunity" revenue resulted in a saving of $69,862.

Tap audit test. The tap auditors began targeting known areas of high illegal use, which are multi-dwelling units. The goal was to convert at least 25 percent of the illegals. Prior to beginning the audit, the team decided to test two methods of approaching the customers with illegal service to determine which method would be more effective in converting them to paying customers.

Complex 1 contained 100 apartment units. Of that number, 24 were found to be illegal. A "hard-sell" letter, written and signed by the security manager, was sent to each illegal. Within days, a salesperson personally contacted the individual resident. Using this method, 12 of the 24 illegals were converted.

Complex 2 also contained 100 units. Of that number, 20 were found to be illegal. A "soft-sell" letter, written and signed by a sales representative, was sent to each illegal. Within days a salesperson personally contacted the individual resident. This method converted five of the 20 illegals.

Results of the external campaign

Electronic scrambling countermeasures were begun in October 1992. This procedure destabilizes illegal convertors and chips primarily affecting the pay-per-view illegals. Comparison of revenue for fourth-quarter 1992 to fourth-quarter 1991 has shown an increase of 10 percent of pay-per-view purchases.

Combating theft of service is the challenge for the future of the cable industry.

Electronic "channel swap" countermeasures against residential pirates identified 258 illegals of which 167 are potentially prosecutable. The main goal was not to generate income, but to generate publicity and advertise the fact that Comcast was instituting a "get tough" policy toward pirates. Because the intention was to prosecute in federal court, 20 irrefutable cases were selected. These have all been filed.

Negotiated settlements of other residential cases have resulted in $13,552 in revenue. Four of the cases were settled for $2,000 each.

The investigations of commercial establishments pirating pay-per-view uncovered 35 bars receiving unauthorized programming. Currently, 13 are in litigation in federal court and nine have negotiated settlements, generating $32,969 in revenue.

Summary

During the expansion years, theft of service and security management were not even considerations. However, current industry estimates put lost income due to cable theft at about 20 percent of annual gross revenues.

With today's slow growth in the subscriber base, a considerable percentage of revenues generated will come from streamlining the organization and instituting an effective theft of service program. This calls for the formation of permanent security departments for major cable systems throughout the country.

The program requires a team approach, enrolling all departments in the effort to stop theft. Security must be included as a member of the team. The cable industry, which is service-oriented, needs the input of the security point of view at the policy-making level. Potential security risks can be detected during policy development rather than implementation. This proactive approach will allow for greater control and creativity, rather than the typical reactive approach, which amounts to "putting out fires."

The team approach is paramount to the success of the endeavor. Other members of the team will serve to buffer the firm stance taken by security personnel. There is a need to enlist every department, every employee as well as the general public, all of who need facts about how cable theft affects management, employees and the honest consumer. Having all departments represented on the team makes these goals more realistic.

This is just the first major crime wave to specifically affect the cable industry. Theft is an evolutionary process. As soon as we offer a service that must be purchased, the criminal element will devise a plan to obtain it illegally. As countermeasures are devised, they come up with new techniques; as new programs are presented, they ferret out weaknesses and take advantage.

Combating theft of service is the challenge for the future of the cable industry. Comcast, through its team approach, has set up a security program that has, in six months, generated $149,000 in revenue and lost service.

The gauntlet is down. CED

Cable TV: at a crossroads

News analysis

By Gary Kim, CED

There's a word to describe what lies ahead for the cable TV industry. Metamorphosis. For like a caterpillar entering its cocoon, the cable TV industry will emerge from the coming transition period as a creature far different than the one that went in. "Whatever we are today, we won't be in five years," says David Woodrow, Cox Cable operations vice president. What's ahead is the erasure of all the boundaries separating today's telecommunications industries–cable TV, local telephone, long-distance telephone, cellular telephone, paging and private radio. Those line of business distinctions, as a practical–not simply legal and regulatory–matter, will disappear completely sometime within the next five to 10 years. Without a doubt, "cable is at a crossroads," says Geoff Roman, Jerrold Communications vice president. "It's conceivable 10 years from now that you'll have one provider offering cable, telephone and personal communications service."

The future role of the country's cable and telephone industries was explored during "Convergence '93," a two-day conference hosted by Multichannel CommPerspectives in Denver in May.

Regulatory barriers fall

More significantly, the regulatory and legal barriers that keep these players from being in any of the other businesses likewise will come crashing down within a scant 12 months to three years. "The fully-interactive, full multimedia market will all be here in five years," says Woodrow. "The Chinese wall (separating cable and telephone) will come down in one to three years."

The fully interactive multimedia market will be here in five years

What we're facing, then, is more than an explosion of new competition in virtually all of the telecommunications fields, though that development, in and of itself, will have far-reaching implications.

What's more important is the virtual disappearance of the existing structure of the telecommunications business, today, largely differentiated by line of business restrictions. Cable TV companies deliver video. Local telephone companies (Local Exchange Carriers, or LECs) handle local telephone service. Long-distance firms (Interexchange Carriers, or IXCs) carry long-haul traffic. Cellular carriers operate only in the wireless arena. Paging companies don't carry voice. Private radio carriers deal mostly in bursty voice messages, typically offering quality far inferior to the wireline telephone network. In tomorrow's world, all that will have changed.

"We're an end-to-end business communications provider, not a long-distance carrier," says Rick Calder, MCI Communications Corp. director, personal communications services. "We must serve customers end to end, with mass market products." Among the products MCI wants to provide is PCS, working with local market partners to provide a national brand identity, nationwide roaming and interoperability and local, on-the-ground presence. AT&T, which already has acquired a 33-percent stake in McCaw Cellular Communications, appears also to have a similar strategy in mind.

BOB SULLIVAN

Brendan Clouston of TCI

McCaw is the largest U.S. cellular telephone carrier, and arguably the fastest-growing. McCaw operates in 100 markets, areas representing 100 million potential customers, or "POPs." About 80 percent of those potential customers live in the 30-largest U.S. population centers. Though cellular is licensed as a local business, on a location-by-location basis, what McCaw has built is a single, national cellular business.

AT&T's long-distance network will improve the McCaw network's ability to provide roaming capabilities and new types of wireless data services as well. Under terms of the agreement, McCaw also can sell under the AT&T brand name, and have access to AT&T's marketing, sales, customer service and distribution channels. Not to mention access to the resources of AT&T Bell Laboratories.

BOB SULLIVAN

David Woodrow of Cox

Keep in mind that AT&T has purchased an option to buy enough shares to control McCaw. That means AT&T will ultimately control more cellular licenses than any other U.S. carrier, and be able to sell service through its nationwide network of AT&T Phone Centers.

AT&T back in competition

If none of this seems remarkable, consider that

BOB SULLIVAN

Rick Calder, Geoff Roman, Sue Mason, Mark Vonarx and Roger Brown discuss convergence issues.

the AT&T-McCaw merger represents the first time since the Bell system breakup in 1984 that the regional Bell companies (RBOCs) and AT&T will be in a head-to-head competitive situation. Where AT&T was forbidden to be in the local telephone business, McCaw puts the company back in, albeit using a wireless local access technology. The upshot is that both AT&T and MCI have sent clear signals that each will be an end-to-end provider of telecommunications services, erasing the distinction between an IXC and a LEC, between a cellular carrier and an IXC in the process.

Then there's the US West Inc. investment in Time Warner Entertainment Co. What's the difference between a cable company and a local telephone company? Separately, US West has announced that it will upgrade all networks within its own 14-state territory, giving US West the ability to deliver video entertainment. Southwestern Bell, on a more-limited scale, also has acquired two cable networks outside its operating territory, and is partnering with Cox Cable Communications, obviously to seek further opportunities.

Tracking PCS as a business

US West's cellular unit, New Vector, also sees great opportunity in the wireless arena. "The PCS opportunity is enormous," says New Vector President John DeFeo. "In 1981, we talked about three percent total cellular penetration. Today, we think it's north of 30 percent, around the year 2010. Others think it could be bigger." The PCS opportunity also could be significant. "Ten years out, we think PCS is a $40 to $60 billion business," says Sue Mason, US West public policy director.

But here's where the lines between businesses blur further. US West serves about 10 percent of the U.S. population, "so 90 percent of the people don't live where we are," says Mason. As a result, "we need to get outside our service boundaries," she says. "There's no reason we shouldn't compete with others in their core business. We know people will attack ours."

Today, competitive access carriers (CAPs) are firms that compete with local telephone companies to offer private line service to business customers. Today, all the U.S. CAPs combined don't earn much more than a few hundred million dollars a year. Altogether, private access is a $5 billion annual opportunity. But the private access business pales before the $40 billion local telephone market, $17 billion annual switched access business and $11 billion regional long-distance market.

Watch for CAP growth

While private access is nothing to snort at, "nobody's going to retire on private access," says Phil Allen, vice president of Teleport Denver, one of two CAPs operating in the Denver area (Jones Lightwave Ltd. just turned up its own network in the downtown core area as well). So the next move for all the CAPs is into the area of switched services and switched access. That, in turn, will expand the potential market to the point that the $200 million annual revenue CAPs earn could mushroom into a $1 billion market by 1996, argues Bob Prichard, Jones Lightwave Ltd. general manager.

Teleport Communications Group President Bob Annunziata agrees that vast growth lies ahead. "We're already providing pay phone service and our own operator service," says Annunziata.

"We aren't just a private line provider. We don't feel we are a CAP. We are a local telecom company. We believe we are a full-service telecom provider."

Though not all CAPs may elect to take this course, "very soon the CAP extends to the residential market," predicts Roman. Today's cable operators will likely play a role in that change, as they begin providing "two-way voice over their standard networks, and use the same platform for PCS as well," Roman says. The point is this: "we are all communications carriers."

That's precisely the point. The cable TV industry is headed for a period of convulsive upheaval, a time when it ceases to be a simple provider of video entertainment with statutory protection and becomes part of the wider U.S. telecommunications industry. Nothing will be the same, ever again. CED

The cable TV industry is headed for a period of convulsive upheaval

Mark Manning and Larry Nelson, Comm/Scope, receive award from Comcast's Richard Pulley and Charlie Cerino. Far right: Frank Drendel, Comm/Scope

Comcast names Comm/Scope "Supplier of the Year" for 1992

HICKORY, N.C.–Comm/Scope has won Comcast's 1992 "Supplier of the Year" award for the second time in a row. Comcast selects the winner based on the results of a survey of all the Comcast systems around the country, plus the corporate engineering and purchasing groups. The survey includes subjects such as total quality level of service and products, and competitive pricing.

TDMA, FDMA calls made

PORTLAND, Ore.–ADC Kentrox announced it has successfully completed simultaneous TDMA and FDMA calls over its CityCell digital, fiber-fed microcell system. The air interface for the calls was provided by a single wideband transceiver in a CityCell remote unit, located on ADC Kentrox premises. The remote CityCell is connected to both TDMA and analog AMPS radios at a Cellular One cell site by optical fiber. (Cellular One/Oregon is currently testing TDMA technology in its Portland network system.)

"This even signifies CityCell's transparency to multiple air interface standards, and underscores its capability to help carriers bridge the transition from analog to digital," explains Peter Carson, a senior product manager for the Wireless Systems Group at ADC Kendrox.

AOFR receives ISO-9001 rating

CANBERRA, Australia–AOFR Pty Limited, an international supplier of fiber optic couplers and splitters, has received ISO-9001 certification via third-party certifier Det Norske Veritas of Norway. The International Standards Organization 9000 is an internationally recognized standards-setting group that initiate quality standards which allow organizations to minimize risk to customers, while maximizing efficiency. Third-party external certification provides proof that the standards have been met or exceeded.

ISO-9001 is a model for quality assurance in design/development, production, installation and servicing. Among the ISO-9000 standard, it is the most comprehensive and demanding, AOFR officials say. The scope of the ISO-9001 standard includes design and process control, inspection, testing and traceability.

AWS fires up Minneapolis system

PHOENIX–American Wireless System has announced the launch of a wireless cable system in the Minneapolis/St. Paul metropolitan statistical area (MSA).

Transmitting from the IDS Tower in downtown Minneapolis, the company will provide wireless cable or microwave television cable service to potential customers. American Wireless System is a joint venture between Short Takes, Inc. and Wireless Cable TV Associates #38, a Californian general partnership. Short Takes will manage the operations and own a 25 percent interest in the joint venture.

The Minneapolis system currently offers 28 television channels to subscribers, including four premium services, for a lower average cost than traditional or hardwire cable services, Short Takes officials say. The company has also signed a letter of intent to develop a similar system in Memphis, Tenn. Under the terms of the agreement, the company will acquire a number of wireless cable licenses in the greater Memphis area from Multipoint Television Distributors for a combination of cash, 150,000 shares of Short Takes stock (valued at $2/share) and a loan. The company plans to begin transmission in Memphis in early 1994, providing wireless cable services to as many as 50,000 potential customers in Tenn., Ark. and Miss., officials say.

Bull funds SecaGraphics

BILLERICA, Mass.–Joining Time Warner and TCI, Bull HN Information Systems has announced the acquisition of an equity position in privately-held SecaGraphics Inc., a computer-aided engineering and operations applications software developer for the cable industry. The value of the transaction was not disclosed.

According to Bull officials, the investment was made in support of the company's aggressive marketing efforts in the CATV industry. The new equity arrangement will help both companies leverage SecaGraphics expertise for cable operators.

Competitive council formed

WASHINGTON–Leading cable operators, Bell operating companies, long-distance carriers, cellular firms, computer hardware and software companies, broadcasters, publishers, banks, universities, and labor unions joined with the Council on Competitiveness recently in an "unprecedented display of cooperation," Council members say.

The meeting was initiated to speed the development of 21st century information infrastructures for the U.S.

"Although the U.S. now enjoys the world's most advanced information infrastructure, that competitive advantage is not assured," says George Fisher, chairman of the Council on Competitiveness and CEO of Motorola, Inc.

"Stakeholders in government and industry must commit to a cooperative relationship–perhaps unlike any they have ever known–to develop an information infrastructure that is in the nation's best interest, rather than the interest of any particular industry structure.

The group has already released a policy report titled "Vision for a 21st Century Information Infrastructure," the first in a series of such reports. The document defines what an information infrastructure re-

ally is, asses the U.S. position in comparison to international competitors, addresses the roles of government and the private sector and outlines the next steps to be taken by the Council.

Corning earns ISO-9002 rating

CORNING, N.Y.–Corning Inc. has received ISO-9002 registration for its optical fiber manufacturing facility in Wilmington, N.C. The 9002 standard sets quality system thresholds for manufacturing of a company's product, and is a subset of the larger ISO-9000 standards.

"This world-recognized standard for quality adds a new level of convenience and confidence for Corning's customers," says Gerald J. McQuaid, VP, manufacturing and engineering for the company's Telecommunication Products division.

Jerrold/G.I. inks deals

HATBORO, Pa.–Jerrold/General Instrument has announced a series of deals with domestic and international cable operators, including IBC Cable of Bangkok, Thailand; Eurobell, Ltd. of the U.K. and Viacom Cable of Pittsburg, Calif.

Jerrold will supply IBC Cable with addressable, wireless convertors for the system's existing MMDS system in the Far East. Over 800,000 TV households will have access to IBC signals in greater Bangkok.

This is the first use of addressable technology for IBC; installation began recently with five channels of programming and "several premium programs," Jerrold officials say.

Eurobell will purchase roughly $2.5 million worth of Jerrold equipment, including its ICFT on-screen graphics convertor, 750 MHz distribution and fiber optic technology. The equipment will be used to build Eurobell's Crawley, Horley and Gatwick franchise areas in the U.K.

And in California, Viacom Cable will use Jerrold gear to upgrade its Pittsburg system (in the San Francisco Bay area) with addressable, on-screen display convertors which include RF-impulse PPV capabilities. In the deal, Viacom will purchase 100,000 convertors and associated headend equipment as a part of the Pittsburg and other upgrades.

Public Cable, WGME-TV agree

PORTLAND, Maine–WGME-TV and Public Cable Co. have announced the purchase of ghost canceling equipment from Philips Broadband Networks. Prior to the installation of the equipment, Philips officials say, cable subscribers had received complaints from subscribers concerning minor "ghosted" images on the channel carrying the local station (WGME). To remedy the problem, Public Cable and WGME purchased Philips Vector ghost canceller.

Hong Kong picks Power Guard

OPELIKA, Ala.–Power Guard has announced it will supply Wharf Cable of Hong Kong with power supplies for its system build, in construction now. The system has 1.6 million passings, and is expected to be completed within three years.

Also, Power Guard has announced it will sponsor a graduate fellowship in Auburn University's Electrical Engineering Department.

In making the award, Power Guard CEO Curt Cope said that the relationship with Auburn's Engineering Department fits into his long-term strategy of keeping Power Guard at the forefront of the rapidly evolving powering field for cable television and communication industries around the world.

In a related announcement, Power Guard has announced the opening of a new engineering building at the company's international headquarters. The 3,500 square foot facility will house Power Guard's lab research and development center, as well as office space, a library, a media center, and product demonstration and training rooms.

S-A inks Navy, Chinese deals

ATLANTA–Scientific-Atlanta recently won two separate bids with the U.S. Navy and a joint venture entity in the People's Republic of China.

S-A will supply $7.9 million worth of equipment to the U.S. Navy as a subcontractor under prime contractor Westinghouse, Inc. The equipment will be used to support production of the Navy's AN/SQQ-89 combat system.

S-A's Signal Processing Systems Division in San Diego, Calif. will perform the subcontracted work, which includes the production of power supplies, voltage regulators, power distribution units, control drivers, power amplifiers and an onboard trainer.

The AN/SQQ-89 combat system will integrate anti-submarine warfare sensors, track management and weapon control on board U.S. Navy DD963 "Spruance Class" destroyers, CG47 "Ticonderoga Class" guided missile cruisers and DDG51 "Arleight Burke Class" guided missile destroyers.

In a separate announcement, Scientific-Atlanta has announced its entry into a joint venture with four telecommunications companies in China for the manufacture of cable TV distribution equipment in Shanghai. The joint venture is intended to serve the cable industry in China, which is expected to grow rapidly, S-A officials say. The largest 300 Chinese cities–with 300 million people, 79 million homes passed and 70 percent TV penetration–are expected to begin cable system construction "in the near future," S-A says.

S-A will have majority ownership and operational responsibility for the joint venture, which will initially be capitalized at $10 million. The other partners in the venture are Shanghai Optical Fiber Communications Corp., Shanghai Radio and Television Development Corp., Shanghai Post and Telecommunications Industrial Corp. and Shanghai Jim Ling Co., Ltd.

Texscan announces Korean deal

EL PASO, Texas–Texscan Corp. has announced it will supply Goldstar Cable Co. of Korea with its optical transmission and opto/RF network devices for Korea.

Under the agreement, Goldstar may also distribute Texcsan products internationally. Texscan equipment had previously been chosen and installed by Korea Telecom in the Korean CATV Pilot Project System, Texscan officials say.

Goldstar Cable is a Korean manufacturer of coaxial, fiber optic, high-voltage and multi-purpose cable.

TV/Comm, AVEX agree

SAN DIEGO–TV/Com International has announced an agreement with AVEX Electronics for the manufacture of its new line of satellite and video compression products.

AVEX, a contract manufacturing company, specializes in high-volume, fine-pitch surface mount technology and integrated turnkey assembly. The deal was struck to ensure any additional factory capacity required to meet production schedules as TV/Comm produces its new line of digital compression products for the cable television industry.

Viacom acquires ICOM

NEW YORK–Viacom International has announced the acquisition of ICOM Simulations, a software development firm which publishes CD-ROM and cartridge-based video games.

ICOM will be folded into Viacom New Media, which was created as a unit of Viacom Entertainment late last year to develop, produce, distribute and market interactive software.

Wegener, Jones cooperate

DULUTH Ga.–Wegener Communications has begun shipment of its DR180 digital audio subcarriers to Jones Satellite Networks. The MPEG-based equipment will be used by Jones for the company's newest radio format, CD Country. CED

Automation control systems

SIOUX FALLS, S.D.–New from Advanced Audio Visual Systems are two systems designed for the cable and broadcasting industries. Its EVA automation control system, based on the company's ESbus line, controls broadcast stations, network master controls and video libraries.

Its Access 200 turnkey system was designed to increase buy rates of premium and PPV movie channels, multiply the effectiveness of local ad channels and provide subscribers with an electronic guide, all on one channel. The system works by providing a multiplexed image. The 12 outside screens of the configuration can be programmed with "most favorite" channels; or, new banks of 12 channels (up to 36 channels) can be displayed in one to 99 second intervals. Circle Reader Service No. 41

New trunk bridger from Augat

MANSFIELD, Mass–Augat Inc. has announced release of its SDA MiniFlex trunk bridger, designed for cable operators looking to add fiber to their service architectures, or for telco operators looking for a less expensive trunk bridger without sacrificing performance specifications in shorter cascades from fiber nodes.

The product features three dedicated hybrid outputs, a 90-percent efficient switch mode power supply to reduce power consumption, a crowbar surge protection to reduces RF plant outages, and pre-and interstage pads and enlargers for improved distortions and reduced alignment. The amplifier is available in bandwidths up to 1 GHz. Further, a plug-in AGC module is available. Circle Reader Service No. 42

Satellite-tracking software

BOULDER, Colo.–Baylin Publications has announced release of its "Satellite Toolbox" software, a menu-driven program with four components including a satellite database, aiming section, antenna sizing and analysis component.

The satellite database lists all of the world's communication spacecraft and affiliated programming carriage. Information such as video and audio programming, transponder bandwidths, center frequencies and polarization formats is included in the database.

The aiming section performs automatic calculations of magnetic deviation, compass heading, and azimuth bearing; the antenna sizing section aid operators with system parameter selection, such as G/T, S/N ratio, C/N ratio and fade margins for satellites within view of a selected site. The analysis module calculates various parameters relating to satellite reception, including gain, beamwidth, focal distance, path loss, and slant distance. The software is available for $95; catalog available upon request. Circle Reader Service No. 43

Fiber optics training videos

KENT, Wash.–The Light Brigade has announced availability of five new fiber optic training videos which address concerns including components, test equipment, and safety.

(*CED* reviewed the company's "Fiber Optic Safety" training video in its April edition. For more information, see *CED*, April, 1993, p.113.)

Titles of the new training series include:

- ✔ "Introduction to Fiber Optic Theory and Fiber Structure"
- ✔ "Fiber Optic Cable, Preparation and Installation"
- ✔ Fiber Optic Connectors, Splicing

Microwave transmitter

TORRANCE, Calif.–New from Cable AML is its ITX-1260 CARS-band broadband transmitter, which it calls "the most powerful available." The transmitter has output power equivalent to that of a 1260 watt amplifier, and features a modular design with easy-to-read diagnostics, Cable AML officials say. The unit will includes a fail-soft architecture which enables service restoration at lower power levels without service interruption; a doubly-redundant configuration is also available. Circle Reader Service No. 44

MMDS signal level meter

MIAMI, Fla.–Comex Worldwide Corp. has announced availability of its new "MOM" (for MMDS Operator's Meter) signal level meter, designed for use on over-the-air, MMDS and cable television signal level measurements. What makes the unit unique, Comex officials say, is that the conventional need to haul extension cords, power supplies, downconvertors, antennas, a signal level meter and associated jumper cables is eliminated. With its MOM unit and an integrated antenna/downconvertor, technicians can "go anywhere" to measure MMDS signals.

The unit offers frequency response of 50 MHz to 812 MHz, with accuracy of ± 20 kHz. Internal switches convert the unit from NTSC to PAL or SECAM video platforms for international use. The meter comes with a padded carrying case, battery recharger/power supply and a car battery cord for "on the road" recharging. Circle Reader Service No. 45

VBI data blanker

ROSWELL, Ga.–New from Electronic System Products Inc. is its Model TG-100 VBI data blanker, designed to provide a low-cost means with which to remove data from the vertical blanking interval of a television signal in cases

VBI data blanker

Five new training videos from The Light Brigade

and Patch Panels"
✔ "Fiber Optic Testing, Troubleshooting and Documentation"
✔"Fiber Optic Safety"

The set is currently being offered at a special price of $650. To address both domestic and international training needs, all videos in the series are available in both NTSC and PAL formats. The tapes can also be purchased individually.

Also, the Light Brigade has announced release of a new video, titled "Lasers and Applications," designed and developed for laser industry professionals.

Light Brigade officials explain that the new laser video addresses a wide variaty of concerns, and is targeted for both the novelist and specialist in laser technology. The training tape covers the background of lasers, how they work, types of lasers and their applications. Laser trends and development are also explained, Light Brigade officials say. Circle Reader Service No. 40

where the data provider does not have a distribution contract with the operator.

According to James O. Farmer, VP of ESP, television broadcasters and cablecasters are beginning to sell more of their VBI space to external data providers, and as such a number of cable operators have expressed concern over losing the ability to participate in this data distribution business–which has been ruled to be the property of the cable operator.

The TG-100 works by selectively removing data on lines 10-20 in the VBI of any baseband signal. It does not remove the closed captioning data located on line 21, which cable operators must pass. The unit does not require rack space, and is designed to fit "almost anywhere" in the headend, Farmer says. It features a failsafe relay which bypasses the active circuitry in the case of a power failure.

In addition to being used to remove data from the VBI, the TG-100 can also remove noise from any line(s) in the VBI. This is useful when the cable operator is using that line to measure noise introduced in the distribution plant (as part of FCC tests). The TG-100 is priced at $250.00, with quantity discounts available. Circle Reader Service No. 46

Optical power meter

UTICA, N.Y.–New from Laser Precision Corp. is its LP-5025 handheld optical power meter, a low-cost unit designed to measure optical power. When combined with a light-emitting diode (LED) or laser light source, the unit also measures optical link loss.

LP-5025

Features of the meter include a measurement range of +10dBm to -70dBm, memory storage of up to 100 loss measurements, a pass/fail mode with user-definable thresholds, and report printing capabilities via an optional RS-232 interface. The unit also offers 27 calibrated wavelengths, with primary windows set at 780 nm, 850 nm, 1300 nm and 1550 nm. Circle Reader Service No. 47

Fiber inspection microscope

LACONIA, N.H.–Noyes Fiber Systems has announced an expansion to its line of fiber optic connector inspection microscopes through its OFS300-400x microscope. The microscope offers 400x magnification and allows for a more precise inspection of polished connectors or cleaved fiber ends. It includes a snap-on connector interface, so as to center the connector. The microscope also includes a built-in laser safety filter for use when viewing connectors on active transmission systems. The microscope can be purchased as a standalone or complete set. Circle Reader Service No. 48

Microwave fiber link

ALHAMBRA, Calif.–New from Ortel Corp. is its Model 10038A microwave fiber optic link, designed for use with the company's Series 10,000 line. the link allows direct access to the uplink RF test port in control rooms.

As Ortel officials explain, satellite earth station operators have to monitor the composite transmitted RF signal to verify signal levels, noise, intermods and spurious noise. With the 10038A, the microwave signal from the uplink RF test port is brought back to the control room directly over the fiber optic link.

Also new from Ortel are two C-band fiber optic links, the 10035A and 10037A, also part of the company's Series 10,000 line. The Model 10035A is a 3.265 GHz to 4.2 GHz link; the Model 10037A is a 5.825 GHz to 6.425 GHz link.

The links, designed for satellite earth stations, use directly-modulated, high-speed analog DFB lasers to transmit multiple transponders over a single fiber, at the actual satellite band frequency, between the control room and the antenna. Circle Reader Service No. 49

Wall-mountable patch panel

S. PLAINFIELD, N.J.–New from Radiant Communications Corp. is a 96-port indoor wall-mount fiber optic patch panel.

The unit features a lockable trunk compartment and can also accommodate eight fusion splice trays for splicing/pigtailing applications. Circle Reader Service No. 50

All-in-one optical receiver

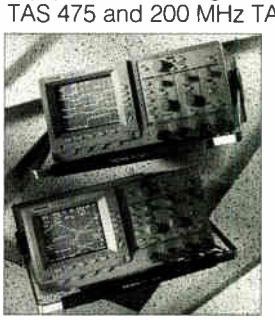
ATLANTA–Scientific-Atlanta has introduced a new "all-in-one" optical receiver which fits into the lid of S-A's existing System Amplifier II. When combined with the SA-II, the new receiver becomes a fiber feeder amplifier suitable for fiber-to-the-serving-area (FSA) topologies.

The receiver features a 1.5 GHz bandwidth platform, simplified bandwidth expansion via the reversible signal flow feature of the SA-II, a platform for advanced system monitoring, reverse video and wave division multiplexing applications, and dual cable inputs to accommodate RF switching of redundant fiber routes. Maintenance of the receiver is simplified, S-A officials point out, because of the unit's modular construction, which separates optics and RF sections.

The device is capable of interfacing with future personal communications networks (PCNs) and offers an individual module LED display to alert technicians of any problems during field checks. Circle Reader Service No. 51

Four-channel oscilloscope

BEAVERTON, Ore.–Tektronix has announced the release of two new four-channel oscilloscopes designed for video equipment servicing. Its new 100 MHz TAS 475 and 200 MHz TAS 485 scopes feature a full range of amplification and attenuation, Tek officials say, and can display multiple channels.



TAS 475 and TAS 485 oscilloscopes

Both units include an autoset feature for automatically triggering and displaying a selected signal; both have time and voltage cursors with display readouts, dual time base, save/recall setups, self calibration and a simplified user interface.

The scopes weigh 17 pounds are UL listed. The TAS 475 is priced at $2,395 and the TAS is priced at $3,495. Circle Reader Service No. 52

CONVERGENCE II

Interactive Services

September 13 & 14 • Santa Clara, Calif.

Convergence '93 is being presented by a coalition of companies who believe it is critical to the industry's future to bring this information to conference participants.

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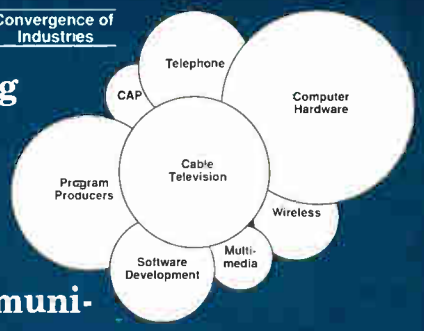
Television is on the threshold of a major change in programming. Providing the next generation of interactive, multimedia-based services will require a unique new partnership between the cable, computer and entertainment communities. The Convergence II conference will be a gathering of the creators, technologists and business professionals who will create and supply these services, with executives from the companies who will market and distribute them to consumers, to explore what these new services will include and what it will take to bring them to market.



Conference sessions will include...

Cable's Role in an Interactive, Multimedia Video Marketplace–A blue-ribbon panel including a cable operator, computer executive, programmer, electronic program guide developer, multimedia producer and interactive network official will provide a look at the video marketplace of the future.

Navigating on a 500 Channel, Interactive Ocean–An in-depth view of consumer look, feel and compatibility issues including electronic program guides and navigational systems, remotes and other interactive input devices, and set-tops.

Will Video Be On Demand? Is cable on the verge of blowing the video rental business out of existence, or is Video on Demand too expensive to deliver on the scale that consumers want? And, will customers be comfortable adding to their cable bills?

500 Channels, Digital Compression and Interactivity...You Want it When? A technical/non-technical briefing and brainstorming of what capabilities producers of this new generation of programming want...and what the engineering community can provide in what time frame.

As well as sessions on...

- What Does Interactive Mean? What Does Multimedia Encompass?
- Interactive Sports
- Interacting with Kids
- Making the Billing/Information Support Transition to Transaction
- Interactive Educational Services
- Shopping/Retail Services
- Interactive Advertising
- Interactive Entertainment
- Sex, Sin and Personal TV

Session topics and speakers subject to change.

For full information return this coupon to Jayne at CommPerspectives, 600 S. Cherry St. #400, Denver, CO 80222. Phone 303/393-7449. Fax 303/393-7139.

Name _____

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The issue: in-home wiring

We'd like your thoughts this month about in-home wiring policies and practices. Some companies charge for additional outlets, while others leave the in-home wiring and additional outlets up to the homeowners. How do you feel about the subject? Feel free to write out additional comments at the end of the survey.

The questions:

1. Does your system believe in installing high quality components for the drop portion of the system?

❑ Yes ❑ No ❑ Don't know

2. If so, is that a change in attitude compared to a few years ago?

❑ Yes ❑ No ❑ Don't know

3. Does your system use in-house installers?

❑ Yes ❑ No ❑ Don't know

4. Does your system use contract installers?

❑ Yes ❑ No ❑ Don't know

5. If you use contract installers, would you say they generally perform good work?

❑ Yes ❑ No ❑ Don't know

6. Some predict a high-quality drop system will be needed to deliver digital signals to the home. Do you think your system can deliver a digital signal between the tap and the house?

❑ Yes ❑ No ❑ Don't know

7. Does your system consider the drop to be a "system" that should rarely be broken open?

❑ Yes ❑ No ❑ Don't know

8. Does your system provide drop cable to local home building contractors free of charge or at a discounted price?

❑ Yes ❑ No ❑ Don't know

9. Does your system encourage homeowners to wire their own homes?

❑ Yes ❑ No ❑ Don't know

10. Does your system charge homeowners a fee to wire their homes for additional outlets?

❑ Yes ❑ No ❑ Don't know

11. Does your system charge a monthly fee for additional outlets?

❑ Yes ❑ No ❑ Don't know

12. Does your system suffer from excessive direct pickup interference?

❑ Yes ❑ No ❑ Don't know

13. Would you favor making high-quality coaxial cable, splitters and connectors generally available to the public?

❑ Yes ❑ No ❑ Don't know

14. Would you favor a program where the cable company would be responsible for only the outside plant, much like the telephone company approach to maintenance?

❑ Yes ❑ No ❑ Don't know

15. Do you have any general comments related to installation practices or policies of the industry?

Comments:

FAX US

Make a copy of this page and fax it back to us at:

303-393-6654

or mail it to CED, 600 South Cherry Street, Suite 400, Denver, Colo. 80222. We will tally the results and print it in a future issue. Your suggestions for future questions are always welcome.

We also want some written comments from you on this subject. Names won't be published if you request your name to be withheld, but please fill out the name and job information to ensure that only one response per person is tabulated.

Your name and title (optional)

_____

_____

_____

System name:

_____

Your MSO:

_____

Location:

_____

Your job function:

_____

RESULTS

Our survey about signal leakage and proof testing found cable operators generally satisfied that they have licked the signal leakage problems that led to strict FCC regulation that took effect three years ago. The survey also found that most operators have integrated the leakage testing and correction functions into their routine plant maintenance schedules, making it easier to meet the leakage specifications as outlined by the FCC.

Perhaps the primary reason the leakage issues have largely been solved is because system and MSO management has adopted the proper attitude and provided the resources to combat the problems. For example, every respondent to our survey said his managment takes signal leakage seriously and 75 percent of those returning surveys said they have adequate resources to perform the regular leakage monitoring.

On the subject of proof testing, 75 percent said they were satisfied with the way their systems performed in the January proof-of-performance test, but only half said their systems would deliver a 43 dB carrier-to-noise ration signal to the home without an upgrade between now and 1995, when that spec comes into play.

The issue: Signal leakage

Remember the big rush to meet the signal leakage compliance deadline in 1990? Doesn't it seem like that was a lifetime ago? We wanted to find out if signal leakage is still troublesome or whether cable systems have largely licked the problem. Here are the results of each question we asked:

The results:

1. Would you say the management of your system takes signal leakage seriously?

100%	**0%**	**0%**
Yes	No	Don't know

2. Do you think your system has greatly reduced or eliminated signal leakage when compared to a couple of years ago?

75	**25**	**–**
Yes	No	Don't know

3. Does your system find it difficult to meet leakage specifications on an ongoing basis?

25	**75**	**–**
Yes	No	Don't know

4. How does your system perform signal leakage tests?

Flyovers?

25	**75**	**–**
Yes	No	Don't know

Drive-outs?

100	**–**	**–**
Yes	No	Don't know

Other methods?

25	**75**	**–**
Yes	No	Don't know

5. Would you say you have adequate equipment and resources to perform regular leakage monitoring?

75	**25**	**–**
Yes	No	Don't know

6. If you could grade your system's leakage performance, what grade would you give it?

A = 50	**B= 25**	**C= 0**
D= 0	**F= 25**	

7. Has your system been inspected by the FCC anytime in the past year?

75	**25**	**–**
Yes	No	Don't know

8. If so, was the FCC satisfied with your leakage levels, logs and procedures?

100	**–**	**–**
Yes	No	Don't know

9. Do you think your system would pass if a leakage inspection were to take place this month?

100	**–**	**–**
Yes	No	Don't know

10. Speaking of inspections, were you satisfied with the way your system performed in the proof of performance tests in January?

75	**25**	**–**
Yes	No	Don't know

11. Will your system be able to deliver 43 dB carrier-to-noise ratio to the home in 1995 as is?

50	**50**	**–**
Yes	No	Don't know

12. Overall, would you say your cable plant delivers high-quality video?

50	**50**	**–**
Yes	No	Don't know

JULY

6 Rocky Mountain SCTE Chapter, Testing. Installer and BCT/E exams to be administered in all categories at both levels. Call Ron Upchurch, (303) 790-0386, ext. 403.

8 Satellite Tele-Seminar Program. "SLMs: The Technician's Edge." Galaxy I, Transponder 14. Sponsored by Calan, ComSonics, Sencore, Trilithic, and Wavetek. Call SCTE headquarters (215) 363-6888.

8 Penn-Ohio SCTE Chapter Technical Seminar, Testing. "Competing Technologies." Installer and BCT/E exams to be administered in all categories at both levels. Location: Sheraton Hotel, Warrendale, Pa. Call Marianne McClain, (412) 531-5710.

12 Florida SCTE Chapter Technical Seminar. "Headend Equipment and Combining Techniques," "Set-top Devices" and "Transportation Systems." Location: Ft. Lauderdale Holiday Inn. Call John Tinberg, (407) 747-4998.

12-15 ONI's Fiber Optic System Training. Four-day comprehensive overview of fiber optic technology. Topics include basics of fiber optics, engineering parameters, construction techniques, splicing, path testing, transmission path electronics, system design, architecture and more. Cost: $1,500. Location: Denver, Colo. Call (800) FIBER-ME.

13 Chattahoochee Chapter Technical Seminar. "Fiber Optics" with Marty Mason. Location: Mason, Ga. Call Hugh McCarley, (404) 843-5517.

13 Magnolia SCTE Chapter Technical Seminar. Location: Ramada Coliseum, Jackson, Miss. Call Steve Christopher, (601) 824-6010.

13 Wheat State SCTE Chapter Technical Seminar, Testing. "Back to Basics–Part III." BCT/E exams to be administered in all categories at both levels. Call Lisa Hewitt, (316) 262-4270, ext. 191.

Trade Shows

July 14-16 Rocky Mountain Cable Expo. Location: Aspen, Colo. Call (303) 863-0084.
July 31-August 3 Wireless Cable '93. Location: Marriott's Orlando World Center, Orlando, Fla. Call WCA, (202) 452-7823.
August 16-18 Great Lakes Cable Expo. Location: Indianapolis, Ind. Call (317) 845-8100.
August 17-21 Canitec '93. Location: Mazatlan, Mexico. Call 011-52-5-682-0173.
August 25-25 Eastern Cable Show. Location: Atlanta, Ga. Call (404) 255-1608.
August 26-27 Safety '93. Location: Tysons Corner, Va. Call Multichannel CommPerspectives, (303) 393-7449.
September 13-14 Convergence II: Interactive Services. Location: Santa Clara, Calif. Call Multichannel CommPerspectives, (303) 393-7449.
September 15-17 Taipei Satellite and Cable '93. Location: Taipei, Taiwan. Call Cable and Satellite TV Guide, 011-886-2-778-5818.

14 Badger State SCTE Chapter Technical Seminar. "Hands-on Fiber Optics." Location: Holiday Inn, Fodulac, Wisc. Call Brian Revak, (608) 372-2999.
14 Heart of America SCTE Chapter Technical Seminar. Location: Kansas City, Mo. Call Don Gall, (816) 358-5360.

14 South Jersey SCTE Chapter Technical Seminar, Testing. "Intervention of the Telcos" with Irene Picard of NJCTA, "Bellcore–Dover Project" with Alan Goldberg, "Multiplexing/DigiCipher" and "Opportunities for New Jersey." Installer exams to be administered. Location: Ramada Inn, Vineland, N.J.

15 Mid-South SCTE Chapter Technical Seminar. Call Bob Allen, (901) 365-1770, ext. 4110.

15 Chesapeake SCTE Chapter Testing. Installer and BCT/E exams to be administered in all categories at both levels. Location: Rockville, Md. Call Scott Shelley, (703) 358-2788.

15 Gateway SCTE Chapter Technical Seminar. Call Chris Kramer, (314) 949-9223.
16 Lake Michigan SCTE Chapter Technical Seminar, Social Event. "Distance Learning" in the morning; golf outing in the afternoon. Location: Elk Rapids, Mich. Call Karen Briggs, (616) 941-3783.

16 Greater Chicago SCTE Chapter Social Event. "A Day at the Races." Location: Arlington Park. Call Bill Whicher, (708) 362-6110.

17 Big Sky SCTE Chapter Technical Seminar. "BCT/E Categories I and II Review" with Marv Nelson of the SCTE. Location: Outlaw Inn, Kalispell, Mont. Call Marla DeShaw, (406) 632-4300.

17 Cactus SCTE Chapter Technical Seminar, Testing. "Fiber Optics." Installer and BCT/E exams to be administered in all categories at both levels. Location: Albuquerque, N.M. Call Harold Mackey, (602) 352-5860, ext. 135.

17 Chaparral SCTE Chapter Technical Seminar. "Fiber Optic Architectures and Technologies." Call Scott Phillips, (505) 761-6253.

20 New York City SCTE Chapter Technical Seminar. "Digital Compression" with Dan Sutorius of Jerrold/General Instrument. Call Rich Fevola, (516) 678-7200.

20-22 Jerrold/General Instrument Technical Seminar. Digital transmission, fiber optics, advanced addressability, rebuild/upgrade planning, FCC compliance, system design and corrective maintenance to be discussed. Designed for cable system engineering management. Location: Sheraton at Bradley Airport, Hartford, Conn. Cost: $300. Call Ginny Morris, (215) 956-6445.

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Cable TV's latest acronym: FTWYCMM

By Archer S. Taylor, Director and Senior Engineering Consultant, Malarkey-Taylor Associates

Only a Welshman could possibly pronounce it! Generating acronyms has become a fashionable R&D laboratory game, filled with hopes of achieving proprietary fame. Take, for example, the various fiber optic architectural designations:

FBB

Fiber Backbone. The first application of fiber in distribution was designed to break up large distribution networks into several smaller ones, each with an optical node near its center.

CAN

Cable Area Network. Bob Luff, then of Jones Intercable, moved the node to the near edge of each of the smaller areas to avoid having to turn part of the system around to accommodate the backfeed.

FTF

Fiber-To-the-Feeder. Fiber optic trunks would be extended to the bridger amplifier, eliminating trunk amplifiers entirely. Of course, this led to designing longer feeders, using "distribution amplifiers" that might be called "quasi-trunk amplifiers."

FTB

Fiber-to-the-Bridger. Same as FTF.

FTSA

Fiber-to-the-Service-Area. This is based on considering the number of households served by each fiber optic node rather than on the particular coaxial network topology.

FTT

Fiber-to-the-Tap. Fiber lines would reach all the way to the tap.

FTC

Fiber-to-the-Curb. This is a telco designation, similar to cable TV FTT, but generally suggesting larger tap clusters than customary with cable TV.

FTTH

Fiber-to-the-Home. A dream for the future, maybe.

FITL

Fiber-In-The-Loop. A telco concept suggesting subcarrier demultiplexing at various points between the central office and the "curb," or home.

All of these acronyms, and even some fine-tuned derivatives, represent indistinct segments of a continuous spectrum. Although there are real differences, they are like the colors of the rainbow, which have no definable boundaries but blend smoothly one into another.

A more realistic definition of fiber penetration into the network is the average number of households served by an optical node. The original backbone provided a node for as many as 10,000 subscribers. Current designs provide nodes for an average of 500 to 1,500 households. Plans for the near future contemplate 200 or fewer households per node.

Most upgrades and rebuilds today depend on fiber optic architecture to reduce long cascades. With shorter cascades, channel capacity can be expanded without degraded noise and intermodulation. Higher gain modules may facilitate upgrading without respacing. The sharply reduced number of active devices in each subscriber link means fewer failure points and enhanced reliability. Maintenance becomes easier; therefore, less costly. Picture quality at the end of the long lines may be substantially improved.

The cost of incorporating fiber optics in upgrade and rebuild plans may be more than offset by the improved saleability of new programming in the expanded bandwidth, as well as the better quality and reliability of the product. Moderate fiber penetration in the upgrade or rebuild (1,500-2,000 households per node) is not likely to add more than 5 percent to 15 percent to the cost. In fact, some reports indicate actual net savings resulting from astute use of fiber.

Fiber, however, makes its most powerful appeal because of its impact on bidirectional transmission. In part, this is also because of the reduced service areas made possible by fiber penetration. Exposure to ingress in these small serving areas is not cumulative over the entire system. The fiber trunks are themselves virtually immune to ingress. Separate fibers, or frequency bands for each serving area, combined with conscientious leakage monitoring, largely eliminates aggregate noise and ingress interference in the return path.

The spectrum for return transmissions in the coaxial serving areas could be allocated where ambient electromagnetic power density is far less than in the traditional 5 MHz to 30 MHz band. Plenty of bandwidth is available on fiber for return transmissions to be carried either by frequency division multiplex at 1310 nanometer, or by wavelength division multiplex at 1550 nanometers.

Hybrid cable TV networks, rich in fiber content, are capable of providing full-fledged bidirectional telecommunication services.

This is the Lorelei, the enchantress beckoning us into the golden world of interactivity, transactions, information services, competitive access, PCS and even POTS (plain old telephone service). Fiber optics is perceived to be the password, the Open Sesame, to untold revenue streams. But don't be misled: new revenues are surely out there. Yet, more than fiber optics is needed to reap the harvest.

"It's a jungle out there", and the industry is well positioned to lead the way.

The key, then, to decisions about how far to go with fiber in rebuilding or upgrading is found in that hard to pronounce acronym at the head of this article:

FTWYCMM*

Fiber-To-Where-You-Can-Make-Money. CED

*Source: Several individuals who shall remain anonymous.

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