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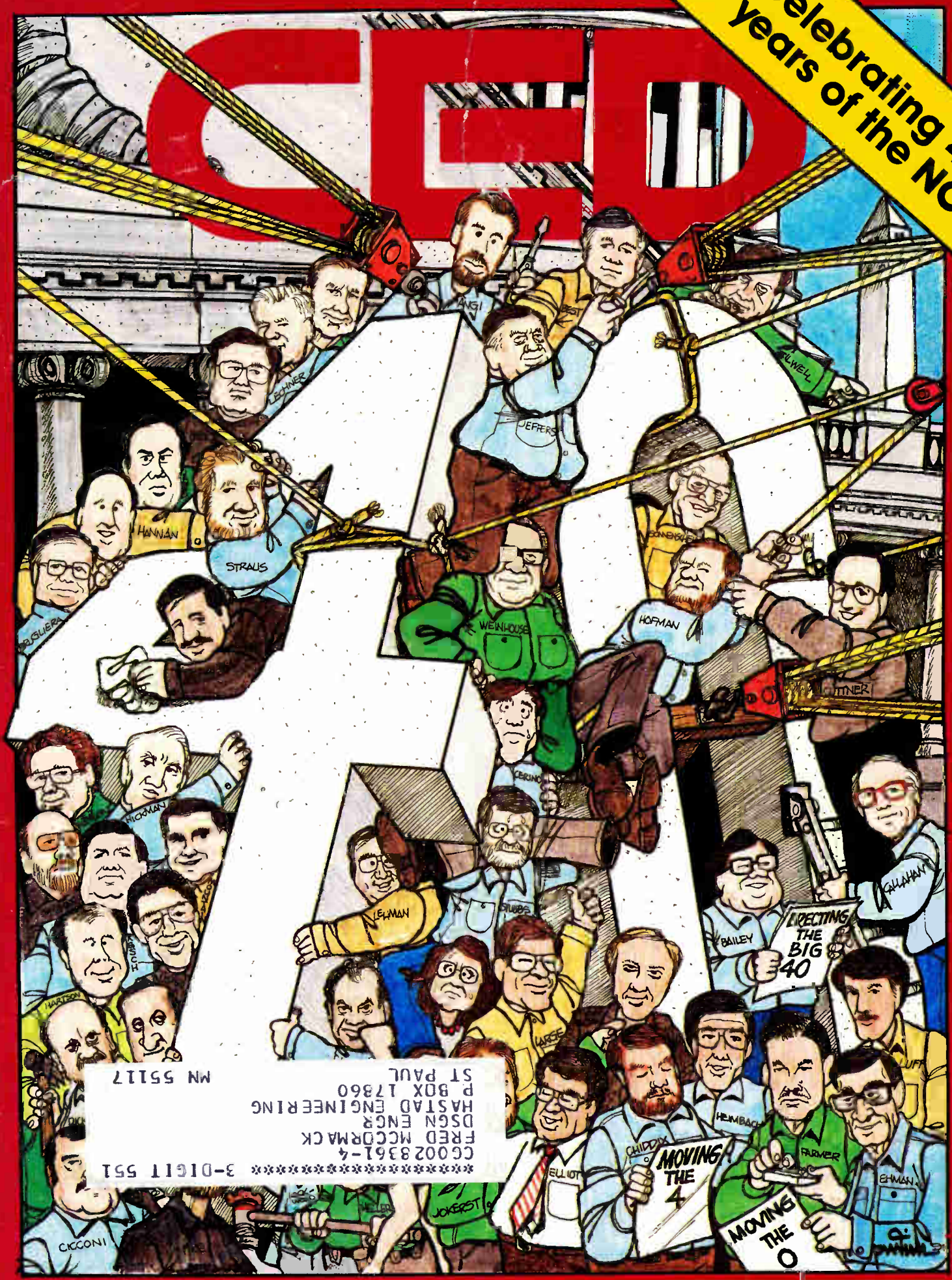
Celebrating 40 years of the NCTA



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May 1991

CED

Volume 17, Number 5

Celebrating 40 years of the NCTA 27
It's often taken for granted, but the influence of the NCTA Engineering Committee is evident everywhere. From its humble beginnings nearly 30 years ago, the august deliberative body has transcended biased interests and factored in numerous milestones. *CED*'s Leslie Ellis examines the personalities and issues related to the Committee, giving perspective to its past accomplishments and future challenges.

Compression and interdiction are the talk of New Orleans 42
The NCTA's 40th annual convention was driven by technology—and not just fiber optics. Digital video compression and its ramifications on future programming dominated discussions of the future, while the re-emergence of outdoor interdiction, spiced with a look at PCNs, promised new methods of system operations. The *CED* team of Roger Brown, Leslie Ellis and Kathy Berlin provide a complete wrap-up.

PCN and what it means to cable-TV 62
Geoff Roman of Jerrold Communications takes a look at the emerging personal communications network and examines the issues cable operators should keep in mind as they work to make PCN fit in their systems. He suggests an effort to standardize frequencies, modulation type, power and cell spacing to help get the service off the ground.

Narrowcasting programming via wavelength 72
Next to no one in the CATV industry is disputing the wisdom of fiber implementation. However, as operators wrestle with how to accommodate emerging technologies and programming, a debate over the merits of 1550 nm fiber gear has reared up. This article by *CED*'s George Sell examines the issue of broadcast and narrowcast over fiber optics.

Building a new communications infrastructure 82
As the CATV network evolves from the traditional tree-and-branch architecture delivering entertainment to a more complex communications network resembling stars and rings, network flexibility will be key. ONI's Andy Paff takes a look at how a cable network can be adapted to include a number of new services.

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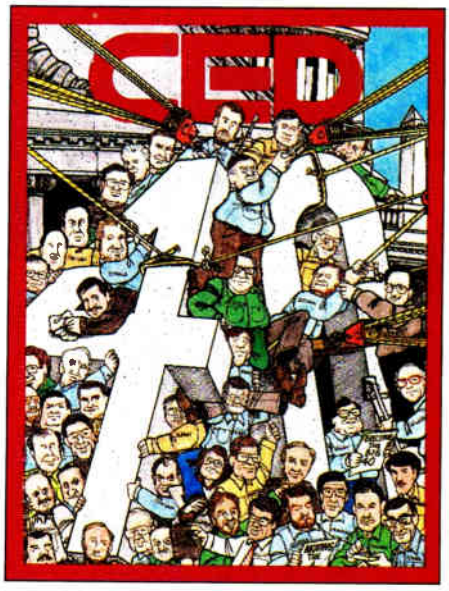
CED. (USPS 330-510) (ISSN 1044-2871) is published monthly except twice in May by Diversified Publishing Group, a Division of Capital Cities Media, Inc., 825 7th Ave., New York, NY 10019. ©May 1991, Volume 17, Number 5. Subscriptions free to qualified industry readers. All other U.S. domestic subscriptions are $48 prepaid. Foregin subscriptions are $69. for surface delivery or $96. for air speed delivery, prepaid in U.S. funds drawn on a U.S. branch bank. Second-class postage paid at New York, NY 10019 and additional mailing offices. CED is published on behalf of the cable television and broadband communications industries. POSTMASTER: Please send address changes to CED Circulation, P.O. Box 3043, South Eastern PA 19398. MEMBERS OF THE BPA.



About the Cover:
1991 marks the 40th Anniversary of the NCTA. Illustration by Rob Pudim.

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CONGRATULATIONS - NCTA

It is not change, but the rate of change that will shape the next decade. Technology will separate the innovators from the rest... and the NCTA will continue to provide leadership in the exciting future of cable.

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Reader Service Number 3

Contest Rules: No purchase is necessary. Entries accepted from authorized representatives throughout the United States faxing their names, title and phone number and the phrase "Please enter us in the Midwest CATV Vegas Contest" on his/her company letterhead to 1 303 643-4797. Contest entry is limited to cable television systems companies only. The prize will be awarded in the company name. The winning company will determine the individual to be given the prize. Midwest CATV, its suppliers, parent companies, subsidiaries and ad agency are not eligible. This contest is void where prohibited by law. Only one entry per company is permitted. The odds of winning will be determined by the number of entries received. Contest entries will not be accepted if received by Midwest CATV after May 31, 1991. Total value of the prize is $1,132. Prize includes airfare from anywhere in the Continental United States to Las Vegas, hotel accommodations for three nights at the Flamingo Hilton, hotel taxes and transfers from the airport. No cash or prize substitutions. For more information contact Midwest CATV at 1 800 MID-CATV or write: Midwest CATV Sweepstakes, Fairways I at Inverness, 94 Inverness Terrace East, Suite 310, Englewood, CO 80112. The winner's name may be obtained by writing Midwest CATV after June 20, 1991.

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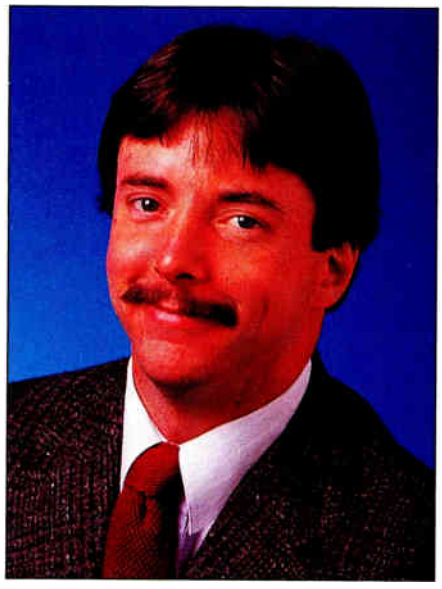
Reader Service Number 4

Relearning a few old lessons

As part of their regular newsgathering process, journalists who cover new, emerging technologies often ask the experts how long it will take for new products to hit the market. As often as the question is asked, however, it's rare to get a direct response. That's because it's tough for the experts to give anything other than a ballpark range that may consist of little more than wishful thinking.

It seems odd then, that when journalists were boldly handed a prediction of when digital television would arrive, many (including myself) reacted with disbelief and incredulity. But it happened. Rewind your thinking just 22 months to the time when John Sie, then senior vice president at Tele-Communications Inc., threw a wrench into the inner workings of HDTV research and suggested that we wait for a "processed digital" approach because television would be a digital medium by the end of the 1990s anyway.



The reaction by many experts was swift and surgical. People called the move a delay tactic, designed to confuse the issue and allow for market acceptance of an enhanced NTSC system built by Yves Faroudja (a technology in which TCI has a financial interest).

Over the past few weeks, in at least two news conferences, Dr. John Malone has gone out of his way to give the press and other onlookers a few "I-told-you-sos." While that could be regarded as a cheap shot, the lesson is a good one: technology is moving faster than most people can (or want) to believe. Through General Instrument's initiative, it appears that whatever HDTV transmission standard eventually is adopted by the FCC, it will be an all-digital approach, something considered unlikely as recently as a year ago, because four of the five proponents have gone to all-digital approaches. (Only the Japanese have opted not to go to an all-digital system, but it doesn't matter—they'll be *making* the new TVs anyway!)

I went back to July 1989 and read my own comments: "Processed digital television...cannot be done—today. And while it is embarassing to say something won't work and never will, there is some question that full-motion video could ever be compressed enough to fit in a 6-MHz channel."

Boy, those words sounded so good back then, but it just goes to show how wrong you can be. But we shouldn't be embarrassed when we can admit we were wrong and go forward. The next thing you know someone will come along and say they've got a 1-GHz amplifier and plan to build a 150-channel cable system in the middle of New York City. Is the sky even a limit?

Roger J. Brown

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Reader Service Number 5

Cable's 'top guns' rally behind call for digital compression

The cable-television industry drew out its big guns in New York and fired a warning shot across the bow of potential competitors, forcing all to take note there's a new sheriff in town.

Before scores of financial analysts and national press representatives, the Top Four cable MSOs took aim squarely at the telcos' midsections and fired several rounds—in the form of digital video compression—that seemingly sent the competitors reeling.

The event was another in a long list of press conferences and open forums where CATV operators and vendors have extolled the virtues of compression in an attempt to reassure financial institutions (and perhaps themselves) that cable has the ability to offer everything its competitors promise, but sooner and less expensively.

TCI CEO John Malone opened the CableLabs three-hour seminar by terming the development of compression "the most exciting stuff in TV in the last 20 years." As he did at press events prior to the National Cable Show as well as during the Show, Malone predicted that compression would spark an "explosion" of new programming start-ups, made cheaper from reduced satellite transponder costs.

Malone's vision is of an electronic video store in the home, delivering 50 to 60 channels of "niche" programming that could be sold on an *a la carte* basis. The delivery of those services is dependent, of course, upon the implementation of hardware, first at headend locations to receive the digitally encoded and compressed signals, and eventually devices in the home that allow cable systems to deliver digital signals throughout the plant. General Instrument and Scientific-Atlanta, who demonstrated their compression schemes to the crowd, said hardware serving the first part of the puzzle would be made available in about a year, while consumer set-tops would be introduced in perhaps two years.

Management driven

Clearly, cable industry excitement over compression has permeated to the top management ranks. Brian Roberts, president of Comcast, said he was "bubbling with enthusiasm" over the potential for inexpensive channel capacity upgrades that will "revolutionize the product we're now offering. What we have today is not really pay-per-view," he added. With compression, "we're talking multiplex cinema with high quality audio and video.

William Schleyer, executive VP of Continental Cablevision, focused on the economic benefits of digital compression. He said Continental's present plan is to upgrade all its systems to 60 channels by the end of 1996, adding that the budget calls for those upgrades to cost between $300 and $600 per subscriber. However, by garnering additional channels via digital compression, Schleyer said the upgrade would cost the operator $200 or less per sub—and the cost would be remanded to those subscribers who subscribe to digitally delivered services. "Compression is the most important technology to come about in years," he concluded.

Meanwhile, Tom Elliot, TCI's chief technologist, termed the advent of compression a watershed event equivalent in importance to satellite program delivery and Jim Chiddix, ATC's senior vice president of engineering and technology, focused on his company's Brooklyn-Queens 1 GHz rebuild, which will not use compression, but will, obviously, provide the industry with valuable information about the value of multichannel PPV.

First field test set

The first field test of video compression will be performed by Cablevision Systems, which has committed to test Jerrold's DigiCable system by the end of 1991. That test, which will be performed in numerous locations throughout the Bronx/Brooklyn and Long Island franchises, will downlink the digital signal at the headend and then remodulate the signal and send it to a handful of digital set-top decoders which will be bicycled to various sites, according to Wilt Hildenbrand, vice president of engineering support and customer relations for Cablevision.

The test will also focus on issues related to propagation over coaxial cable, including group delay and microreflections, Hildenbrand said. That will determine how much forward error correction is necessary in the compression algorithm and whether echo cancelling is needed.

Hildenbrand said it's necessary to commence testing before the end of the calendar year because he'd like to be armed with a certain body of knowledge before the next Cablevision budget cycle begins.

To date, no other operator has publicly committed to field tests, but the four represented in New York are working toward development of programming and marketing efforts that would seemingly thrive in a 150-channel environment.

Roberts said Comcast is actively discussing the purchase of compression gear, but is working to complete its fiber to the feeder upgrade in Palm Beach in order to test multichannel PPV. Schleyer said Continental sees compression as a way to deliver more ethnic programming and regional news channels for its big urban systems like Los Angeles. And TCI is preparing to market movies on demand, which if successful, would require additional channels, said Elliot.

'Open architecture'

One of the toughest issues the industry in general—and CableLabs in particular—must wrestle with is how to create an infrastructure in which different compression hardware and software will be able to operate, while being "friendly" to existing consumer electronics. Labs CEO Richard Green said, "It won't be easy, but the Labs is looking to" allow for different technologies to operate under "umbrella protocols," perhaps by using smart cards. Green said although the task is a major challenge, his 20 years of experience dealing with compression tells him it's "doable, but it depends on industry cooperation."

Compression, HDTV and interactive TV

As the advent of digital video compression opens up more spectrum for niche programming, as TCI's John Malone predicts, the available spectrum can be filled by high definition television and interactive services, more of which are coming on-line as programmers see the potential via CATV.

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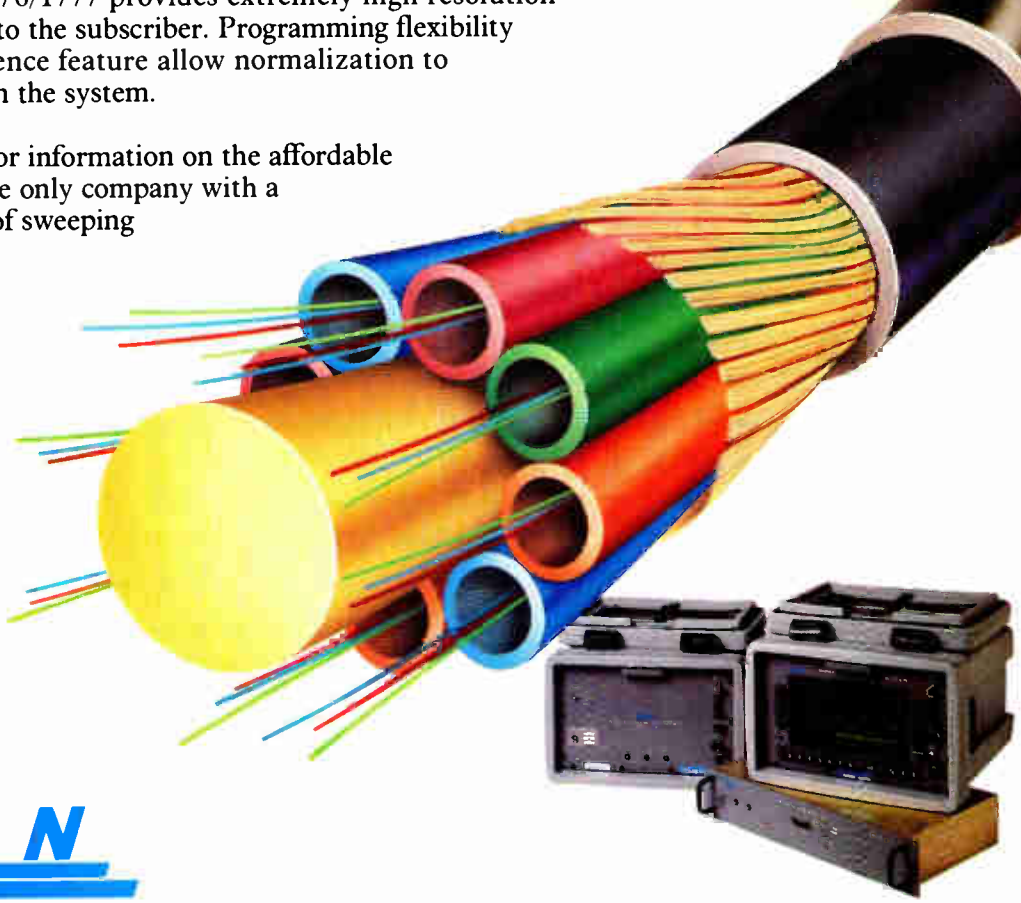

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Reader Service Number 6

with Captain New York to transform the Ed Sullivan Theater in New York City into North America's first commercial HDTV production and transmission facility. Captain will utilize S-A's HDB-MAC equipment.

S-A will also be the first vendor to uplink HDTV programming for distribution to potentially thousands of cable system headends for public demonstrations, according to H. Allen Ecker, senior VP and technical officer at S-A. The project, coordinated by CableLabs and announced last month, is part of a Labs project that calls for showings of HDTV in public locations for one hour a week and eventually moving to daily HDTV airings.

The goal of the CableLabs HDTV project is to show the American public that the cable industry is capable of providing advanced television to its subscribers and to show those subscribers what the next generation of television will probably look like. S-A will likely be followed by GI, which plans to submit two versions of its DigiCipher advanced television system to the FCC for testing.

Interactive TV/computer

The digitization of the cable television industry, the telephone network and the home computer industry is leading toward a convergence of in-home consumer electronics gear, making it more difficult for users to distinguish a telephone or television from a computer, according to organizers and attendees of the HomeMedia Expo, a conference focusing on entertainment, computer and communications technology and programming.

The Expo offered glimpses at CD-ROM entertainment systems, 3-D television, artificial reality and interactive video games. Media experts were filled with blue-sky promises of televisions and VCRs with computers for brains, instant in-home access to multitudes of channels providing video on demand, and making the viewer the ultimate network programmer.

The Expo was dominated by computer software providers, with no representation from the cable industry. However, some exhibitors—especially those offering interactive video services—were keenly aware of the synergies possible between their start-up companies and the conduit to the home provided by cable systems.

Two such service providers, NTN Communications and Interactive Systems, are "actively" talking with cable operators regarding program carriage, according to company officials.

NTN offers a series of sports and entertainment related interactive programs. The company's QB1 service, which allows viewers of NFL football games to predict upcoming plays and compare their play-calling prowess with other viewers in other locations, has been a hit in several sports bars and taverns, according to executive VP Dan Downs.

But the "holy grail" of interactive TV is cable TV because it can easily evolve into an impulse-driven, two-way network, said Downs. And cable operators will desire the programming because it will reduce churn, provide subscriber lift and generate revenue, he added. "The bigger (cable) players see where this is going and recognize they have a lot of channels to fill," Downs said. "Ten years from now this kind of service will be commonplace, providing up to $400 million in revenue."

Interactive Systems plans to launch InTouch TV sometime in 1992 and is busily pursuing cable carriage, according to Jack Galmiche, president. IS developed the technology that made "Wheel of Fortune" the first broadcast interactive game show, Galmiche said.

Neither service is necessarily based on proprietary hardware, but the Smart Box produced by I.S. has a hard-copy printout that allows viewers to receive receipts for products ordered via TV or generate coupons to entice viewers to make later purchases. Both services rely on digital data streams sent in the vertical blanking interval (VBI) of NTSC signals and therefore don't devour additional bandwidth. However, each service does require a channel to display the programming.

Interactive program guide

Video recording devices will also benefit from interactivity, allowing viewers to select programming without consulting printed guides and one-button recording of programs, said Michael Faber, president and CEO of InSight Telecast. His company's system continually updates the television and VCR with new program information and provides viewers with program name, content and length on a channel-by-channel, menu-driven format.

Because the updating is done via data stream sent in the VBI, information such as time of day can be sent along with the program information. This feature would do away with the need for VCR clock programming, a function which is often little more than an annoyance.

Insight and Cable Television Laboratories last month announced an agreement to work toward delivering this type of electronic program guide to cable subscribers.

In addition, "smart" VCRs can read the data and can automatically tune the proper channel for recording at the touch of a single button. Even programs that are pre-empted or run longer than their allotted time (such as sporting events) will automatically be recorded in their entirety because the VCR won't be told to turn off until the program ends. The system would also allow taping by entering only the program title.

FCC grants pioneer's preference

In an action that will have most significance in personal communications networks, the Federal Communications Commission had established rules and procedures that will give preferential treatment in its licensing processes to technology pioneers. The action was taken to assure that innovators have an opportunity to participate either in new services or via new technologies.

The Commission said its a recipient of the pioneer's preference would be effectively guaranteed a license to operate in a new service in one area without competition. This action was taken because the Commission was becoming increasingly concerned that the old method of licensing—which granted innovators no special treatment—resulted in a chilling effect on new technologies and services.

Jottings

It looks as though the long-promised testing by the FCC of advanced television proponents has slipped yet again. Now that the majority of proponents plan to submit all-digital systems, the testing process had to be altered to provide digital tests methods, according to Brian James, director of testing for CableLabs. James said the test will now commence in the second week of July. . . The NCTA Engineering Committee presented a special award to ATC's Walt Ciciora for his four years of service as its chairman. . . The FCC is mulling over a method to stagger the deadlines to submit Form 320s (the CLI form) ■

—Roger Brown

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Reader Service Number 8

Audio quality issues addressed

Some time ago, I wrote an article about audio and its importance in the customer's perception of quality video. It's been proven many times that high quality audio enhances the perception of an enjoyable viewing experience. More importantly, it's been proven that audio can change a customer's opinion about the "quality" of the video signal itself.

Many years ago, there were great debates in broadcast circles about whether or not commercials were louder on average than typical program material. The battle went to and fro, with one camp swearing that there was no difference in loudness as measured through a variety of esoteric ways. Another camp swore that it didn't matter what was measured; the difference could be heard.

Measuring perceived loudness

Finally, the FCC entered the fray and conducted tests in which they "proved" that commercials were perceptibly "louder," but that the difference wasn't necessarily one of absolute meter measurements. Tied in to the entire process and equation was the issue of compression and processing—and for the first time, the importance of perceived loudness versus meter measurements was officially noticed.

By Wendell Bailey, Vice President Science & Technology, NCTA

I've mentioned before that an inordinately large percentage of Engineering Committee time is spent on the discussion of audio and audio related issues. This is understandable, if you remember that we've been struggling to cope with BTSC stereo broadcast signals for at least four years now. And, while we carry them quite well, we have a difficult time actually measuring the performance of this signal as it is delivered to our subscribers.

An increasingly large number of cable systems not only carry BTSC signals from broadcasters, but there are cable channels that are driving BTSC encoders. While all of this debate about the esoteria of BTSC and perceived loudness goes on, the simple fact remains that customers using remote controls and grazing through 36, 40 or 54 channels are constantly annoyed by the differences in audio loudness.

Recently, a subcommittee of the NCTA engineering committee began to work on this problem. Its chairman, Ned Mountain of Wegener, initially told me that after preliminary investigations, he believed that fixing this problem was a monumental task and that, in fact, the entire problem may be intractable. After further study, that chairman admitted that he now believed the problem was almost intractable, but that he had some ideas on how to attack.

Sound ideas

The ideas were sound (no pun intended). In order to attack this problem and cure it, we had to divide the problem into smaller parts and attack each part individually. An analysis of the parts available to us to work on indicated that we should first apply our energies and efforts towards the cable channel uplink facilities. After determining how the audio of different program services was perceived by the operating cable engineers, we set up visits with a couple of program service uplinkers.

I think I can say that what we found both surprised us and led us to believe that there is hope that this problem can be solved on a national basis. The surprise came when we found that the audio plants of several uplinkers were more complex than we had realized, and the number of variables that they must deal with is different for each service.

For example, some services are heavy on live material and light on prerecorded material. Others have just the opposite, with almost no live material and lots of prerecorded stuff. All of those with prerecorded material suffer greatly from the vagaries of the audio quality that comes with that material.

Those with large concentrations of live performance have all of the issues attendant to mike-ing and dealing with the studio environment. In addition, there are programmers who scramble and those that do not; those that sometimes scramble and sometimes do not—and each of these scenarios creates different problems and opportunities for controlling audio. Our message to each of these program services was to find and adhere to a standard for level and deviation that accomplished their desired goals.

Even though these parameters would be different from one programmer to the next, the potential for a cure is enhanced because each service would be setting a desired point to achieve—and sticking very closely to it. Cable headends cannot adjust for varying audio from the networks if a single network varies from hour to hour. They can adjust, however, if a network stays relatively close to the preannounced point.

Consistency, please

In fact, operators are quite willing to adjust for each and every programmer, as long as each programmer is consistent. The good part about these visits was our finding that the cable service uplinkers are manned by highly competent people. All of these highly competent people expressed, right up front, their happiness with receiving a visit from members of the audio subcommittee.

It also turns out that in every case, these people had given considerable thought to the issue of consistent audio through their plants, and were actively working to accomplish the very things that we are. Because there are many times fewer uplinkers than there are cable headends, our first goal is to get the uplink audio providers to stabilize their product so that we see some benefit at the cable headend.

It seems to us to be achievable. And if we find in other uplinks the same quality of people with the same obvious commitment to signal quality, then I believe we'll make some serious headway in this most vexing of problems. ■

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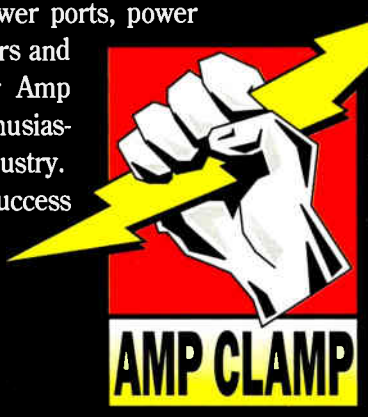

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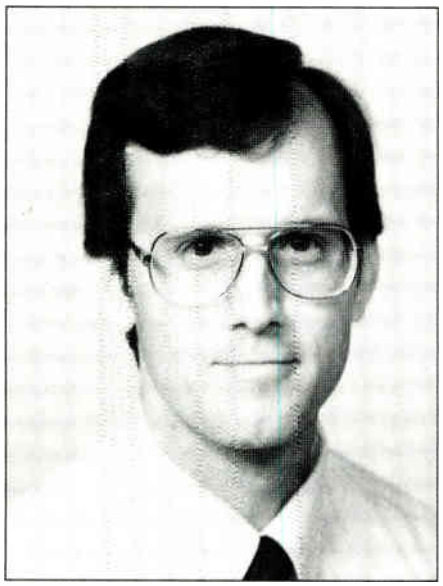


Care and feeding of BTSC stereo audio

While it's true that digital audio and compressed digital video have taken the media spotlight in recent months (I too am guilty; In fact my last two columns have been devoted the subject of digital video transmission), their analog brethren will certainly be around for a long time to come. This month, we'll jump back into the analog audio realm and review some important operational guidelines for ensuring that the analog BTSC signal that we're delivering to our customers today is the best that we can possibly provide.

BTSC stereo has been with us now for several years, and has been shown to be capable of providing very good quality stereo audio in many installations if care is taken to set up the equipment and operate it properly. Operationally, a BTSC stereo encoder can be set up to interface with a CATV modulator in any of several ways. The method of interface is often dictated by the type of modulator that is resident in the headend when the stereo encoder arrives for installation. Typically, the encoder will interface with the modulator either at BTSC baseband, 4.5 MHz audio subcarrier, or as a subcarrier at 41.25 MHz.

A *BTSC baseband* audio interface between the encoder and modulator is probably one of the most tempting, but most dangerous methods of interconnecting the two pieces of equipment. It's tempting, because it seems so logical and simple, and because that's the way (with relatively few exceptions) that audio sources have always been connected to modulators. On the other hand, it's dangerous because in order to maintain good stereo separation, the BTSC signal requires very precise control of audio subcarrier deviation—25 KHz for the L+R signal (compatible with existing monaural transmissions), and 50 KHz for the L-R channel. This precision is required due to the fact that the dbx companding system is used only on the L-R channel.

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

As a result, any error from nominal deviation in the modulator gets translated into loss of separation through the dbx expansion process and matrix process in the BTSC decoder that recreates the left and right channels. The important point to remember is that this interface is crucial in order to maintain adequate stereo separation. If we were to plot audio carrier deviation error versus BTSC stereo separation in an otherwise perfect system, we would have a graph that looked something like Figure 1. Clearly, this graph indicates the need to keep subcarrier deviation levels to within about five percent of their optimum value, or stereo separation will suffer tremendously.

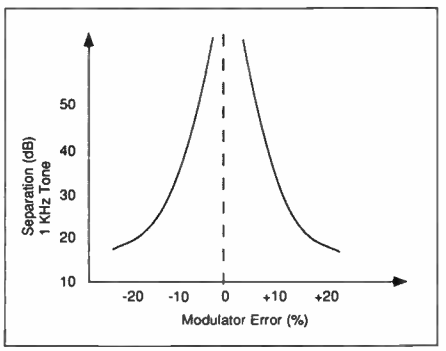
Tweak no more

It is typically recommended by manufacturers that a Bessel null technique, or a test tone, provided by some BTSC encoders, be used to accurately set levels between the encoder and modulator. Once these levels are set, one habit that must be eliminated in the headend is the daily casual tweaking of each modulator's deviation pot. Once the precise deviation levels are calibrated, leave them alone except for scheduled maintenance where precise test tones can be used to ensure accuracy.[1]

The output provided from these stereo encoders will typically be a subcarrier at either 4.5 MHz or 41.25 MHz. Most encoders that provide a 4.5 MHz subcarrier interface to the modulator will generally offer it either on its own dedicated 75 ohm output, or will provide it in combination with the video signal resulting in a video +4.5 MHz interconnect. Often the method of interconnect between the modulator and encoder will be dictated by the type of interface that an already existing modulator will accept.

Generally speaking, it is usually best to keep the 4.5 MHz subcarrier path *separate* from the video path if at all possible. Combined video + 4.5 MHz subcarrier as an input to the video modulator can often lead to interaction between the video and audio paths. This quite often can show up as visible beats in the video signal and/or distortion in the BTSC stereo signal.[2]

Another possible interface between the stereo encoder and modulator is with an audio subcarrier at 41.25 MHz for input into the modulator's IF loop. As with the 4.5 MHz interface, the 41.25 MHz option places the burden on the manufacturer to set up all of the critical BTSC baseband levels and subcarrier deviations. This interface is typically used with modulators that do not have a 4.5 MHz input capability. While interfacing at 41.25 MHz is



certainly straight forward for modulators with an IF loop, one minor drawback that must be considered is that when interfacing at IF, intercarrier frequency tolerance and/or stability between the video and audio carriers must be closely watched. This is because the intercarrier frequency is dependent upon two completely independent oscillator—the audio oscillator in the encoder and the video oscillator in the modulator. With a 4.5 MHz interface on the other hand, the intercarrier frequency tolerance is totally dependent upon the encoders audio oscillator performance, which can be very tightly controlled. Recommended practices call for an intercarrier frequency tolerance of 4.5 MHz ±1 KHz. ■

1. Bowick, Chris, "The importance of setting and maintaining correct signal and modulation levels in a CATV system carrying BTSC stereo signals", NCTA Technical Papers, 1986.

2. NCTA Recommended Practices for Measurements on Cable Television Systems, 1989.

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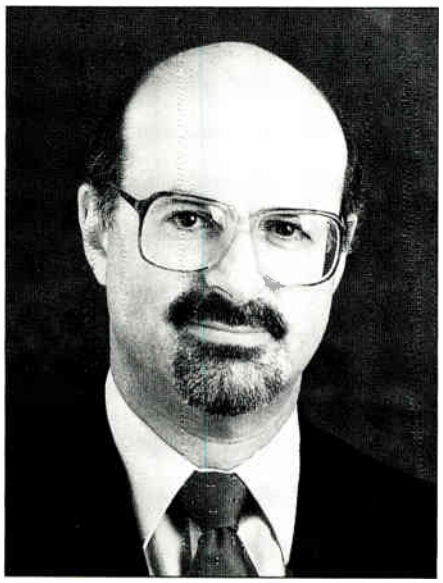

Interactive video and data service

On March 4, 1991, the Federal Communications Commission released a Notice of Proposed Rulemaking to create a new Interactive Video and Data Service. This was a response to the petition filed in 1987 by TV Answer Inc. But a careful reading of the FCC Notice raises some questions about *what* this service will actually be used for, and *who* will use it. In fact, this new service looks like a solution in search of a problem!

The original proposal

The original TV Answer petition requested that the FCC allocate a radio channel for a television viewer-response service. The petition discussed two-way cable experiments and concluded that they had failed because of the absence of a reliable, cost-effective technology to support interactivity between cable subscribers and cable programming sources.

TV Answer originally proposed the use of a single 500 kHz channel at either 216.0 MHz-216.5 MHz, 218.0 MHz-218.5 MHz, or 220.0 MHz-220.5 MHz. The major controversy that has delayed this proposal was whether there would be interference to TV channel 13 (210 MHz-216 MHz). For this reason, the original TV Answer proposal was strongly opposed by the broadcasters. It was also opposed by amateur radio operators, land mobile radio operators, the operator of the Mississippi River ship-to-shore communications network and a manufacturer of seismic telemetry transmitters; all of which operate in the 216 MHz-225 MHz band.

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

The FCC proposal

According to the FCC, this Interactive Video and Data Service could be used for ordering products advertised on home shopping programs, ordering cable TV pay-per-view programming, interactive computer services, student response to live video instruction, etc. But under the proposed FCC rules, it could also be used for downloading data and ordering products and services, separate and apart from any television service. The FCC has not proposed detailed limits on permissible services: "We propose to allow a wide range of types of interactive video and data services" is all it said.

Rather than a single 500 kHz channel, the FCC is proposing to allocate two 250 kHz channels for this new service: 218.00 MHz-218.25 20MHz and 218.25 MHz-218.50 MHz. With two channels, two vendors could offer competing services.

The interference issue seems to have been resolved. TV Answer revised its system design to placate the broadcasters and their concerns about channel 13 interference. The new design is based on 10 50 kHz channels that would be reused throughout an area in a cellular base station plan. These base stations would incorporate reduced power levels to protect against interference. A base station located far from or close to a channel 13 transmitter could use 20 watts of power, but a base station located at a channel 13 Grade A contour would be limited to 7 watts, and at a Grade B contour it would be limited to 1 watt.

Once the FCC decides to accept license applications, the applicants would have to submit detailed plans describing their service. They would have to show that they will provide service to at least 50 percent of the service area. Ten percent of the system must be built within one year, and 60 percent within five years. If the licensee does not meet this requirement, the license would be revoked. This is to prevent "warehousing" of the radio spectrum.

Comments are due to the FCC on June 10, 1991, and reply comments are due July 10. The earliest the FCC might be expected to adopt final rules is early 1992, but based on recent experience that is too optimistic.

Some questions

The FCC proposal raises some questions about who is likely to apply for these radio channels, how they will be used, and TV Answer's role in the future.

There is virtually no limit on what services can be provided, or on who is eligible to apply for these licenses. Even though the original TV Answer proposal expected the uses to be related to cable TV, broadcasting and educational services, eligibility is not limited to cable operators or broadcasters or educational institutions. Because the FCC expects to be swamped with applications, a lottery will probably be used to award licenses.

TV Answer's role is uncertain. The FCC does not propose to give any licenses to TV Answer, nor to require licensees to use TV Answer's technology.

Although the FCC is planning to adopt a "pioneer's preference" in awarding licenses for new uses of the radio spectrum, TV Answer has not asked for any preference in the award of these licenses.

Possibly, TV Answer expects to build the equipment rather than provide the service. But the FCC proposal does not require the use of TV Answer's specific equipment. The proposed technical specifications are generic, and could probably be met by equipment designed for this purpose by other manufacturers. The only limitation is that the radio signal must consist of a sequence of pulses. The TV Answer system modulates the phase and duration of the pulses, but other modulation schemes would be permissible.

On the other hand, it may be that there are only a few truly practical approaches for using this spectrum, and TV Answer is best-positioned to supply the technology. At this point, it is too early to know where this proposed service is heading. Is it really needed? Will licensees use TV Answer's technology, or some other technology? Come back next year for an update. Or maybe in 1993 or 1994—after all, the proposal was originally filed in 1987, so why hurry? ■

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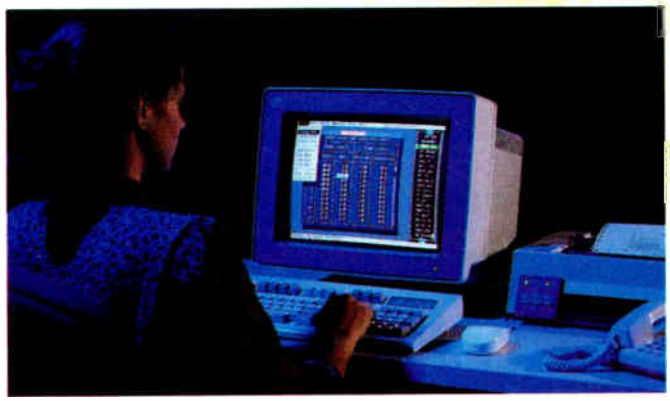

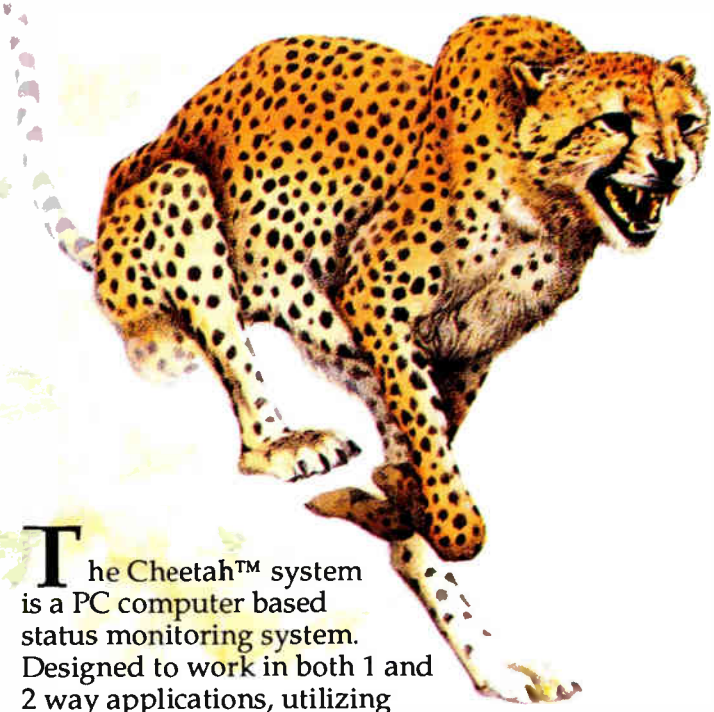

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Some thoughts on fiber optics

Within less than four years, the use of optical fiber has surged from a minor role in cable TV to a position promising to alter the Cable TV landscape as dramatically as did the transmission by satellite of the Ali-Frazier battle in Manila fifteen years ago. I used to be asked: why, if fiber optics is so great for telephony, is it not used for cable TV? Irving Kahn frequently complained that cable TV engineers were too conservative and afraid of new technology.

The plain truth is that, until Jim Chiddix demonstrated otherwise, the conventional wisdom of the experts in the laboratories and universities was that only digital or FM signals could be transmitted on fiber. However, none of the nearly 200 million TV sets in use in the U.S. would work with either FM or digital signals.

Fiber depth

Channel-by-channel conversion from FM to AM is inherently much too expensive for individual subscribers. Therefore, the use of fiber was necessarily confined to super trunks. Since it has been shown that lasers can be modulated with FDM/VSB/AM signals, the drive to extend fiber deeper into the network is now proceeding with vigor and intensity.

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

The blessings of fiber

Shorter network cascades for:
- Better performance
- Reduced maintenance
- Greater reliability

Unlimited fiber bandwidth provides:
- More channel capacity
- Upgrade flexibility

Fiber is:
- Ingress-free
- Secure against wire-tapping, theft of service
- Non-metallic
- Low-loss
- Flat frequency response
- Light weight—highly flexible
- Small diameter
- Long-life; durable
- Environmentally robust

Fiber has:
- Flat frequency response
- Small diameter
- Long useful life

The star-bus network topology made feasible by the small size and low loss of optical fiber yields additional benefits:
- Reduced accumulated upstream noise and interference
- Service area segmentation
- Greater reliability
- Better adapted to duplex operation (e.g. PCN)

Other considerations

Neither the fiber-backbone nor the fiber-to-the-feeder configuration significantly reduces the total amount of coaxial cable required for the system as a whole. Since every household passed requires a coaxial tap port, and all tap ports must be connected by coaxial cable to a fiber node, coaxial cable is required almost everywhere. With fiber-to-the-feeder, smaller size cables may be feasible, and there may be somewhat less back feed and overlashing. But the use of fiber in the hybrid network is not likely to reduce by very much the total length of coaxial cable required.

Fiber to the tap (or to the curb) could, however, eliminate most or all coaxial distribution cable. Existing flexible drop cables by themselves, are broadband, non-distorting, and free of noise generating components. Fiber to the tap may be the next stage in the development; but, not yet.

No matter what manufacturers claim, optical fiber connectors and splices are substantially more sophisticated than coaxial connectors and splices. Fusion splicing technology has been greatly simplified and is probably as near perfect as possible. Nevertheless, it is not well adapted to emergency repairs, with the wind howling in the heart of a blizzard. Demountable connectors have come a long way; but they are not as easy to install, nor as forgiving as F-connectors.

Moreover, losses and reflections are likely to range between excellent and poor, depending in large part on the installer's skill and workmanship. Nevertheless, the inconvenience of fiber splices and connectors is a small price to pay for the advantages of fiber. Just be prepared to accept it philosophically.

It is almost correct to say that once optical fibers have been placed in the ground (or on poles), only the terminal equipment needs to be replaced to keep pace with the advancing state-of-the-art. In general, the common variety of step-index single-mode fiber is not likely soon to become obsolete, although incremental improvements such as dispersion-shifting for wavelength division multiplexing (WDM), and reduced attenuation are to be expected. Fiber optimized for 1310 nanometers may be less than optimum for the 1550 nanometer erbium-doped photonic amplifiers that are coming on fast. A more likely difficulty may be that the routing selected for the installation could turn out to be less than optimum, or even unsatisfactory, for future developments or applications.

The cost of the fiber itself compared with installation labor is now so low that it would almost be irresponsible not to install spare fibers. Technicians will have to learn some new skills in order properly to maintain fiber optic facilities. New instrumentation, such as the optical power meter (OPM) and optical time domain reflectometer (OTDR) will also be required. The new skills are not especially difficult, only different; and the instrumentation is not prohibitively costly.

Optical fiber represents a giant step forward for cable TV, notwithstanding the need to recognize and adapt to those characteristics that differ inherently from coaxial cable. The icing on the cake is that rebuilding with fiber need not be at premium cost. In fact, the costs for fiber systems appear to be a bit less, or only slightly more, than for conventional coaxial networks, depending on the particular circumstances. ■

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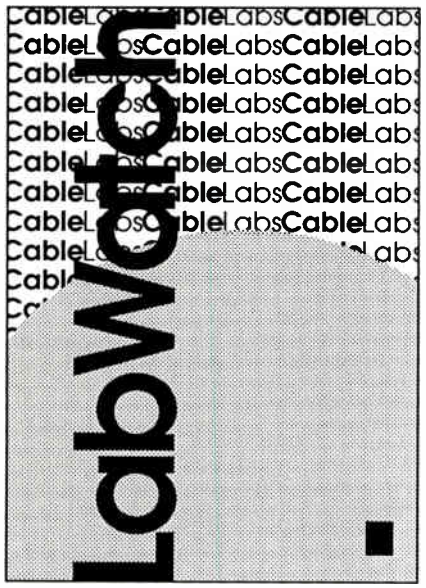


Well-run headend trims costs, supports revenue

Editor's Note: *CableLabs is providing* CED *magazine with a report every four months on various subjects or projects undertaken by the Labs. This inaugural report looks at a novel headend design that has long-term industry implications.*

One of the first projects for David Eng at Cable Television Laboratories was to design and construct a headend. The headend project is geared toward gaining a higher degree of reliability, flexibility and quality. Eng is manager of engineering services at CableLabs, the MSO-funded cable R&D outfit in Boulder, Colo.

Mission: Impossible?

The headend R&D project he directs—like all industry efforts at upgrading signal delivery—has an urgent mission. Today's cable subscribers want fewer service interruptions, better audio and (perhaps above all) a clearer picture to display on the big, high-resolution TVs and monitors they're buying in droves. Disappointed, they may turn to VCRs, laser disks or satellite dishes for their programming.

Last August, in a spanking-clean room in CableLabs' headquarters, Eng installed a 40-channel headend that incorporates countless hours of thinking and tinkering by Eng and top engineers from the MSO and hardware vendor community. It's one flashy roomful, a headend-engineer's nirvana.

Its Scientific-Atlanta receivers and modulators are on open racks that are exposed on all sides. Black cabling runs between them on overhead guideways so exposed that they dare an engineer not to be neat. The specially designed Comm/Scope cables carry both video and audio, "siamesed" together into one bundle—again, an invitation to neatness. The direct cabling scheme eliminates about 600 of the connectors found in a typical 40-channel pre-racked headend (each a source of signal degradation and potential breakdown).

Eng says the CableLabs headend incorporates no startling technological breakthroughs. Rather, he explains, it "was designed to be as simple and as user-friendly as possible." Almost any cable headend can be improved without an equipment-buying binge, according to Eng, former director of engineering at Rogers' Minneapolis Cable: 'Often it's not a matter of swapping out equipment, but of just taking the time to do things the right way."

> A longer-term issue is the role of the headend in any future signal-compression technology.

Basic thoughts

What are some simple, cost-effective ways to improve headend performance? Eng mentioned four:

- Find and use manuals. "They're here somewhere" is the status at many headends of documentation that tell how the equipment should be operated.
- Use the right cables and connectors. Some simple rewiring can yield big improvements in signal quality.
- Attend to climate control, power supplies and clutter. As system capacity grows, air conditioning and powering often don't keep up. No-longer-used cabling, left behind by time-pressured technicians, adds to repair time and confusion. A 65-degree headend performs dramatically better than one that's 110-degrees.
- Control people's access to the headend. Eng recently calculated that a typical 40-channel headend has 504 adjustments to be fiddled with, sometimes by people working at cross-purposes. Another way of putting it: think before you tweak.

In 1991, Eng's project will step up its dissection of headends, passing along the findings to sponsor MSOs. The goal is to make the signal at the headend the highest in quality because a cable television signal doesn't get any better once it leaves the headend.

It also will explore what more can be done to improve audio signals—a source of customer aggravation.

Adding intelligence

Headends, noted Eng, are getting cluttered with a series of switches managing different signal-manipulation tasks, from local ad insertion to syndex, blackouts and cross-channel promotions. CableLabs will be exploring the possibilities for an intelligent switch that could manage all this "manipulation"—an inadequate term to describe a value-adding process which will be crucial to building new revenue streams for cable's future.

A longer-term issue is the role of the headend in any future signal-compression technology. How, Eng asks, will bandwidth-per-channel be shrunk without degrading the pictures on today's NTSC (and tomorrow's even bigger HDTV) screens?

With the industry flirting with digital signal delivery, another long-term issue will be how to insert digital video and audio into the headend signal. It's great, says Eng, that the industry is focusing a lot of attention to improvements "in the field"—fiber-optic trunk lines and all the rest. That's definitely needed, he says.

But focusing on the headend can have big payoffs, too, said Eng. No matter what the feats of engineering in the field, the product on home TV screens can only be as good as what comes out of the headend. ■

A newly published manual detailing the CableLabs' headend project is available to sponsoring MSOs by calling CableLabs at (303) 939-8500.

By The CableLabs staff

Where wouldn't we be?

"Wait until you hear this one," chuckled a National Cable Television Association Engineering Committee member at a recent meeting. Lifting a piece of paper from his folder, he read the letter aloud: "Dear sir: I am the author of *Imponderables: Why do dogs have wet noses? When do fish sleep?*

"I would be most appreciative if you could help me to solve a mystery of everyday life: Why do the volume levels of different cable networks vary enormously, compared to broadcast television affiliates?" The room full of top-level engineers broke into laughter.

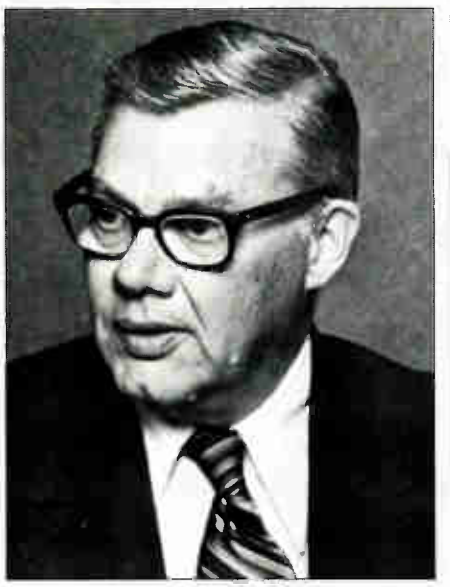
Ironically, though, that question—while not normally posed in that fashion—represents the types of issues the Committee addresses in its bi-monthly meetings, in an attempt to lead cable's engineering community toward the adoption of solid, reliable engineering practices.

The Committee accomplishes this through its variety of technical publications and intensive "bridge-building" efforts to bring cable television's concerns to other related industry groups.

A specific niche

In fact, the NCTA Engineering Committee is viewed by many as one leg of an organizational tripod—including the Society of Cable Television Engineers (SCTE) and Cable Television Laboratories (CableLabs)—that guides the cable television industry through layers of issues and keeps its focus pointed. Where the SCTE targets training and education as its role, and CableLabs delivers research and design prowess, the Engineering Committee acts as an industry liaison between cable and the FAA, the FCC, ham radio operators and the consumer electronics industry—among others.

"The Engineering Committee has traditionally gotten behind engineering issues and given them the push they needed," says Norm Weinhouse, president, Weinhouse and Associates. "It is the one group that has helped the industry attain—or retain—cooperation with the other industries that surround us."



'During my tenure as Chairman, there were two big issues: signal leakage and channelization schemes.'

Frank Bias
Engineering Committee Chairman, 1982-1984

And, of course, it's no big secret that the Washington, D.C.-based NCTA carries considerable political weight—in fact, that weight clearly separates the NCTA from other industry organizations.

"Essentially, the Engineering Committee makes technical decisions that affect the industry," remarks Wendell Bailey, VP of Science and Technology for the NCTA. "And, if need be, the NCTA voices those concerns to Capitol Hill and the FCC."

Forty years, still counting

This years marks the fortieth anniversary of the National Cable Television Association—and although the actual birthdate of the Engineering Committee itself is sketchy (the closest indicators point to the mid-1960s), one fact remains clear: The industry would be light-years behind without the efforts of the engineering group.

Some of the major accomplishments of the Committee are:

- BTSC stereo compatibility with cable television
- Access to mid-band frequencies previously banned for use by television by the FAA
- Permission to use small aperture (4.5 meter) antennas in cable television applications
- Publication of the well-used *Recommended Practices for Measurement Methods in CATV Systems.*

When asked where the industry would be *without* the Committee's efforts, engineers are specific. "We probably wouldn't be in business, actually," muses Weinhouse. Why? Because operators probably would not be using small (4.5 meter) aperture antennas—but instead would still be using the 9-meter monsters that even in the early 1970s carried a huge price tag—upwards of $100,000. "At those prices, it just wouldn't have made sense to be a cable operator," Weinhouse continues.

However, an early CATA petition, backed by the NCTA, was presented to

The Second Annual Meeting of NCTA—1953

1941—National Cable Television Association founded.

1950s—Use of single channel 'strip amplifiers' initiated to carry CATV signals farther from the headend

1953—First microwave relay system delivers distant (Denver, Co.) signals to CATV systems, Casper, Wyo.

1954—Cable-powered and messengered amplifiers

Archiving cable's humble beginnings

An amplifier made from a coffee can; a field strength meter made from an old television set—these are some of the exhibits at the State College, Pa.-based Cable Televsion Center and Museum. Allegedly, the field strength meter replaced, of all things, the shotgun. How so? Apparently, in the early days of cable television, a technician was sent to the top of the mountain and would turn the antenna until the picture was deemed acceptable. When it was good, someone down below would fire a shotgun—that meant "hold it where it is."

But the Center and Museum isn't just about antiquated equipment. In fact, the Museum, established in 1988, serves multiple purposes:

- To provide academic opportunities for cable industry personnel
- To archive the history and development of the industry
- To provide a repository of historical and current documents for study by students or other interested parties
- To monitor the continuing development of cable and other broadband services.

Because the Center and Museum is largely a volunteer effort, several committees exist to continue its efforts. Those committees include:

- Education and training, chaired by Shirley S. Hendrick
- Oral histories, chaired by Benjamin Conroy
- Collections and Exhibits, chaired by Joseph Gans
- Information and publications, chaired by Marlowe Froke
- Finance, chaired by Sandford Randolph
- Financial support, chaired by Burt Harris.
- Continuing education and special programs committee

The Center and Museum is the brainchild of the Cable TV Pioneers and the NCTA Engineering Committee, who approached Penn State in 1985 to inquire about the possibility of establishing an institution at the University. Since then, director Marlowe Froke and the late George J. Barco have lead the concept to where it is today: A multifaceted center serving educational needs and chronicaling the historical roots of the cable business. Currently under the direction of Marlowe Froke, the Museum intends to appoint its first salaried, full-time director in July. Other high priority tickets this year include a research library program, an oral history program and an education and training program.

Research library

Under the research library program, the Center aims to collect industry-specific writings and films detailing the growth of the industry. And, as they are collected, the documents will find an electronic home in Penn State's Library Information Access System (LAIS)—a computerized database that links universities and educational institutions around the globe. The collection will also include representative technical equipment that traces cable's origins and engineering accomplishments.

Furthering the documentation is the Museum's unique oral history program, in which the wisdom of cable's pioneers is captured on audiotape as they recount cable's beginnings. In fact, 19 oral histories are already complete, including authors such as Archer Taylor, Strat Smith (first salaried NCTA employee), James Jimirro and Bill Daniels. But "this isn't merely a project for our pioneers," Froke advises. "The program is designed to be ongoing." In fact, more than 25 more oral histories are in progress to date.

Attracting good people to CATV

Yet another goal cited by the Museum is to serve as a "nationally recognized institution that puts the cable industry in the forefront of scholarly research," Froke explains.

"For us to advance as an industry, we need to attract and maintain high-quality professionals," Froke continues. "This (education and training) projects aims to make that happen."

Interestingly, the Society of Cable Television Engineers (SCTE) has played an important role in the Museum's development by publicizing the search for "milestone-type" engineering equipment.

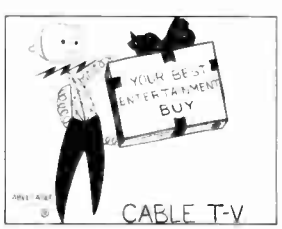
In fact, at last year's SCTE Expo in Nashville, the SCTE booth was littered with "classic" equipment contributed from various industry sources. In addition to the described "coffee can amplifier" and TV-tube field strength meter, the Museum has also received a reel of optical fiber, an early cable (five channel) headend and a 1950s-era vectorscope.

Room with a view

Now, the Museum plans to integrate the equipment into a kind of hands-on, three-dimensional timeline, where one room is dedicated solely to technological developments. Called the "SCTE room," a mural on the walls depicts a typical town with actual utility poles and associated cabling/equipment mounted. The intent, says Froke, is to show a cable system as it developed through four decades.

Why such a concentrated effort to nail down cable's historical roots? "Our industry has come so far, so quickly," Froke smiles. "This is a way of patting ourselves on the back." ■

—Leslie Ellis



Able Cable—1950s

introduced

1957—First all-channel broadband amplifiers (channels 2-13) and cascades (channels 1-13 with FM) introduced

1962—First use of aluminum shielded

distribution cable with foam dielectric used, Meadville, Pa.

1966—AML propagation tests performed, Manhatten,

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Cable's "dirty dozen"

Not many will remember this one. In the early, early, *early* days of cable television, there existed a group of gentlemen who identified themselves (in the trade press, no less) as the "Dirty Dozen." No, they weren't a band of convict soldiers headed by actor Lee Marvin—they were a handful of engineers that met bi-monthly to discuss pressing technical issues.

No one seems to remember all of the participants, but three definites were ex-Viacom engineer **Frank Bias**, **Dick Hickman** of Metrovision and **Jim Stilwell** of Teleservices R&D.

Interestingly, the group's activities closely paralleled that of the current NCTA Engineering Committee. The 12 (some debate lingers as to whether the group more closely resembled a "baker's dozen," with 13 participants) met every two months for two days. During the two day stint, they discussed current happenings in the cable engineering world.

"It was a strong, cooperative effort among the chief technical officers of the top MSOs," reminisces Bias. "We tackled problems with equipment performance, testing and hands-on evaluation."

The second day of the meeting was usually spent touring a "unique" cable system that was utilizing some type of new equipment. "I can remember going to a Warner system in Pennsylvania that had the first harmonic-related cable headend," Stilwell offers. In fact, each meeting had a designated host, whose role was to organize the two-day meeting and line-up the tour.

Towards the end of the gathering, each participant was usually handed an "assignment" to complete by the next meeting; usually to test a piece of equipment being introduced to the market. "We'd go home and test them

N.Y.

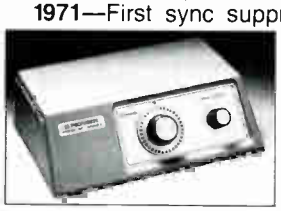
1966—First attention to direct pickup interference addressed with a dual heterodyne set-top converter

Mid-1960s—NCTA Engineering Advisory Committee formed under the direction of Times-Mirror's Herb Michaels

1968—NCTA Standard 005, 'Methods of measuring noise levels,' produced

1971—FCC requests the organization of a cable technical advisory committee

1971—First sync suppression scrambling scheme introduced



1973—Solid state amplifiers and converters (35 channels, 50-300 MHz) become industry standard for construction and operation

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in our garages, sometimes," chuckles Stilwell. "And for that reason, we couldn't take on an official capacity, for fear of lawsuits.

But really, we just wanted to get a grasp on emerging technologies, and to be able to make informed decisions. We weren't in it to give any vendors a hard time."

The group dissolved in the mid-1960s, when the official NCTA Engineering Advisory Committee (now the NCTA Engineering Committee) became a reality. "Engineers were starting to move around within the field," Stilwell recalls. "All of a sudden, we no longer had a good representation of the top MSOs." ■

the FCC in 1976 that allowed the use of the smaller antennas—and gave cable television the cost incentive needed to become the business it is today.

Nine channel systems?

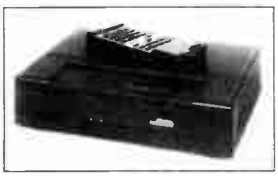
The NCTA won another major victory in 1977 when it blocked the Federal Aviation Administration's efforts to ban cable television from all frequencies not allocated for television. "At the time, the FAA was putting enormous pressure on the FCC because of potential CATV interference with the air communication bands," remembers Archer Taylor, senior VP of engineering for Malarkey-Taylor Associates.

"Had the FAA been successful, it would have left cable with almost nothing to play with at all," Taylor continues. "It would have eliminated three or four channels in the midband, and everything above channel 13."

But thanks to some heavy political lobbying by the NCTA and its then-VP Delmar Ports, the FAA's efforts were stymied by FCC docket 21006, which "was largely a signal leakage issue, but tied in the mid-band concerns," Taylor explains.

In fact, the docket was largely an agreement between the FCC and cable television to swap the additional bandwidth for today's cumulative leakage requirements. "It was an

1975—First joint EIA/NCTA television systems bulletin published
1975—HBO begins satellite delivery to cable headends
1976—Optical applications begun in trunk line distribution applications
1976—FCC ruled for the use of 4.5 meter satellite dishes (previously only 9 meters could be used)
1977—NCTA VP of Science and Research Delmar Ports succeeds in blocking the FAA's efforts to force CATV out of all frequencies not allocated for television.
1980—Addressable converters introduced
1983—The NCTA



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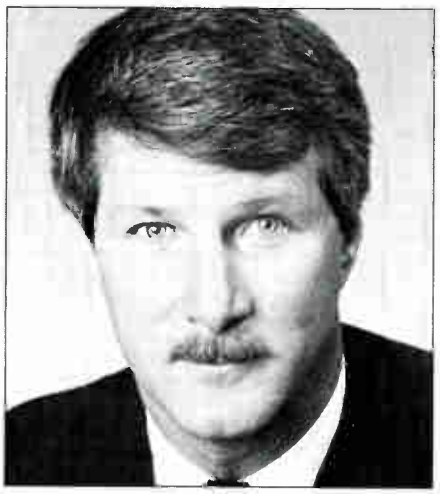
equitable solution for both parties," remembers Bob Luff, chief technical officer for Jones Intercable and chairman of the Committee at the time. "Because of the talent of the Signal Leakage Subcommittee (which Luff organized), we were able to convince the FCC that CATV could deliver a responsible solution to the FAA's navigational concerns. That was the birth of required CLI filings."



'One of my goals as Chairman was to increase membership—to include more senior engineers and make the Committee a technical backbone for the industry.'

Bob Luff,
NCTA Engineering Committee Chairman
1980-1982

BTSC stereo

And in more recent history, the Committee eased the way for BTSC stereo—even if it was a last minute effort. In fact, were it not for the

Engineering Committee publishes recommendations on the satellite delivery of signals to the cable headend

1983—EIA/NCTA docket IS-6 recommends a cable channel identification plan

1986—EIA/NCTA docket IS-15 recommends standard interfaces between television receivers and ancillary equipment. The docket is revised in 1988

1987—NCTA Engineering Committee publishes recommendations on connecting cable systems to ancillary equipment

1988—American Television and Communications debuts an AM fiber system

1989—NCTA Engineering Committee begins work in conjunction with the Advanced Television Test Center to test high definition television proponents

1990—FCC mandates submission of quarterly cumulative leakage index (CLI) reports

*Source: National Cable Television Center and Museum, CED research

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herculean efforts of the NCTA's Sound Quality Subcommittee, headend equipment probably wouldn't be equipped for BTSC at all.

As the story goes, the Committee learned of the Broadcast Television Stereo Committee's (BTSC) plans to standardize a stereo transmission method within months of it becoming a technical reality.

'The decisions made in these meetings are important. They affect the industry in the near and future term.'

Dr. Walt Ciciora,
NCTA Engineering Committee Chairman
1986-1990

"We had to jump on it fairly quickly," remembers Alex Best, senior VP of engineering for Cox Cable and chairman of the committee. But the subcommittee managed to jump in at the eleventh hour and present cable's technical point of view, resulting in a BTSC signal compatible with cable systems.

Interestingly, the BTSC "nightmare," as some engineers refer to it, remains a important lesson to the Committee. Although the BTSC oversight was in no way intentional, it shed color on the importance of building relationships with surrounding industries—before decisions are made that could have a negative effect on cable television. In fact, the Committee's current focus on high definition television (HDTV) testing and standardization is seen by some to be an outgrowth of the BTSC situation. "We don't want to be caught on the outskirts of that technology. We want to be involved from the get-go," comments one Committee member.

And HDTV also illustrates the NCTA's interest in consumer electronic concerns. In fact, in the mid-1980s, a tie with consumer electronics manufacturers was cited as the "most important goal" of the Committee. "When cable-ready sets first hit the market, things got real tricky, in terms of channel assignments," says Walt Ciciora, VP of technology, American Television and Communications. "But the two groups (cable and television manufacturers) got together and worked out a channelization plan that was mutually agreeable." The agreement, known as EIA/NCTA docket IS-6, established a numbering reference for channel assignments that matched settop converter and cable-ready channel displays.

Breaking bread with hams

Another important tie knotted by the Engineering Committee is with

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amateur radio operators. "Hams have a strong (political) arm and could do (cable) serious damage," comments Weinhouse. As such, the NCTA formed the joint ARRL/NCTA subcommittee, chaired by Dovetail System's Bob Dickinson.

"Now, if an amateur radio operator has a complaint about cable system leakage, it gets reported to the ARRL—not the FCC. As a result, the rapport between cable operators and hams is significantly better (than before the liaison was created)," Dickinson explains.

An engineering bible

And in addition its political and bridge-building savvy, the Committee also dedicates its energy to the written word. Perhaps its most well-known publication is *Recommended Practices for Measurement Methods in CATV Systems*—or "the Bible," comments Comsonics' Dick Shimp. Developed by then-Subcommittee chair Mike Jeffers of Jerrold Communications, the book provides an apples-to-apples method for cable-related equipment measurements, as well as providing standardized symbols for strand mapping and fiber optics.

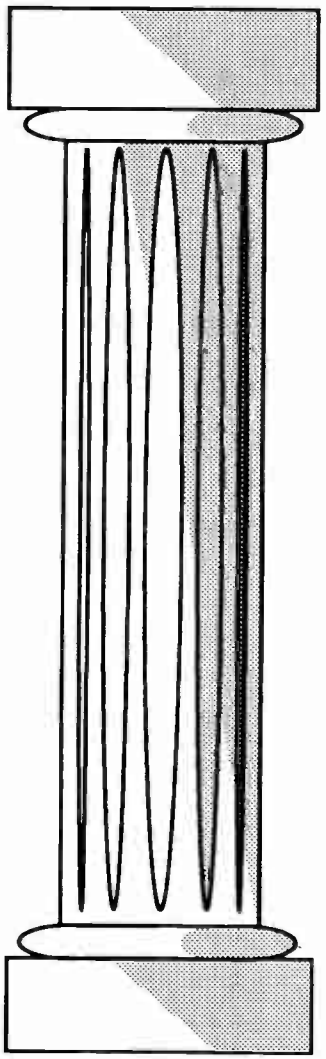
"It's more realistic than the FCC's Part 76 methods," Shimp continues. "It's a recipe approach that provides industry measurement techniques—but most importantly, it references just about everything, and keeps vendors from arguing over which method is best."

'Two things were important during my tenure: Noise and distortion, and what we called 'amplifier overload.' '

Archer Taylor,
NCTA Engineering Committee Chairman,
1968-1970

Not without frustration

The Engineering Committee is not without typical committee-type frustrations, however—particularly time delays. Ciciora's EIA/NCTA Joint Subcommittee is one such example: The group has been struggling for a solution to direct pickup interference (under an IS-23 reference) for nine years. "We all know what the problem is and how to correct it," Ciciora says. "But it's just one of those things that seems to go around and around, largely because it will cost (television



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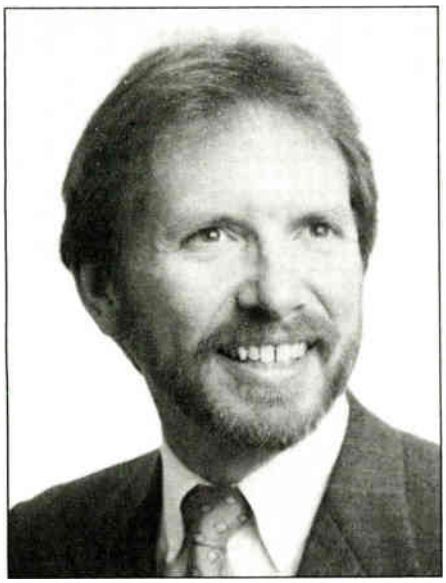
manufacturers) to improve the shielding inside the set."

Another such example is MultiPort—an issue which keeps "rising out of its own ashes," says CableLab's Claude Baggett. Baggett, Chairman of the ad-hoc MultiPort Subcommittee, feels that the plug is the "ticket" to solve a multiplicity of consumer electronics interface problems, but that it's a classic "chicken and egg" implementation syndrome. "Technically, it can work. The problem is getting (the port) manufactured into the television set—which becomes a marketing issue on behalf of the consumer electronics side," Baggett explains.



'My focus is to press on with these new decisions while still concentrating on existing issues.'

Tom Jokerst,
NCTA Engineering Committee Chairman,
1990-1991

A volunteer effort

Despite its frustrations, however, engineers continue to lend time and talent to the Committee's relentless pursuit of engineering solutions. Indeed, one of the truly amazing aspects of the Engineering Committee is the fact that this group of jet-setting, top-drawer and generally on-the-move engineers manages to find two full days worth of time, every two months to participate in this powerful thinktank.

Why? "Because the decisions made in these meetings are important—because they affect the industry in the near and future term," says Ciciora, an engineer whose schedule defines the concept of being "on the move."

"I can remember when there were just six of us," says Frank Bias, an ex-Viacom engineer and former chairman of the Committee. Now, though, more than 60 engineers—representing some 1,000 combined years of hands-on, cable-related engineering—show up on the NCTA's doorstep like clockwork.

"We have a unique chemistry," says Charles Cerino, director of technical operations for Comcast Cable Communications. "It's not just a bunch of engineers talking about dBs. This is leading edge information." Ned Mountain, director of marketing for Wegener Communications, agrees. "When you look around the room and think about the amount of knowledge

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collected between four walls—it's overwhelming. But it's a great blend of people—vendors, operators and programmers."

A full plate

The horizon certainly looks bright for the Engineering Committee—particularly with new technologies popping up at seemingly every turn. "Over the years, we've gotten alot accomplished," summarizes current chairman Tom Jokerst, CableLab's VP of science and technology. "My focus is to press on with these new issues—HDTV and video compression, for example—as well as continuing to concentrate on existing issues, like signal leakage and audio quality."

And who knows: Perhaps someday we'll know why dogs have wet noses, too.

—Leslie Ellis

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What's on the plate?

Like many large groups, the NCTA Engineering Committee is futher subdivided into several working teams to tackle technical problems in need of solutions. Following is an update on subcommittee activities:

HDTV subcommittee

Chairman: Nick Hamilton-Piercy, Rogers Cablesystems. As Hamilton-Piercy explains it, a group of CATV engineers were sitting around one day discussing why television pictures aren't good over cable. As a result of this, an ad-hoc subcommittee was recognized at an NCTA Engineering Committee meeting to address this very question.

They've come a long way. Since its inception, the HDTV subcommittee has developed the test procedures slated for use in the upcoming HDTV tests in Alexandria, Va. So, "for the next little while, we'll concentrate on the testing." But, Hamilton-Piercy emphasizes, "we badly need expert viewers to participate in the test." Volunteers can contact either Hamilton-Piercy at (416) 447-5500 or Brian James at (703) 739-3870.

Satellite practices subcommittee

Chairman: Norm Weinhouse, Weinhouse and Associates. Started in mid-1989, this group aims to settle operator complaints concerning satellite repair and "overall bad service." In the past, Weinhouse says, the subcommittee exerted a great deal of energy with General Instrument's VideoCipher division, resulting in an open letter to the industry that outlined VideoCipher's goals to improve its service and performance (see January, 1991 *CED*, page 78.)

Currently, the satellite subcommittee is working closely with the sound quality subcommittee to concentrate on the problem of audio discrepancies.

Sound quality subcommittee

Chairman: Ned Mountain, Wegener Communications. According to Mountain, the committee is "within reach of publishing a recommended practice on the satellite distribution of audio." Comprised of representatives from the programming, manufacturing and cable operating side, the group has met on several occasions in the past few months as it nears it's desired result. "This all has to do with setting audio

levels," Mountain explains. "If all of the programmers participate, it will give operators a way to get things set properly—or at least using scientific methods.

Multichannel sound subcommittee

Chairman, Alex Best, Cox Cable. Without the efforts of this group, the cable industry would most likely be on the outside looking in at BTSC stereo. Under the direction of Best, however, cable engineers became involved with the standard—when it was within an eyelash of becoming a reality—and emphasized cable's technical position. "The majority of our work was done between 1984 and 1986," Best explains, "When the broadcasters were about to select their stereo standard, we jumped in to ensure compatibility with cable through our converter systems.

"Our work is just about complete," Best continues, commenting that for the past three years, they've simply been monitoring the effects of the revised BTSC standard and keeping an eye on any problems.

Signal leakage subcommittee

Chairman, Ted Hartson. Concerned with the FCC's recent shutdown of three cable systems for leaking beyond acceptable limits, Hartson's group continues to preach the signal leakage gospel within the engineering community. Recent meetings addressed such subjects as filing deadlines (should they be staggered) and frequency registration.

In-home wiring subcommittee

Chairman, Larry Nelson. This group is striving toward the development of recommended guidelines—for use by cable operators, home construction companies and "do-it-yourselfers"—that will address the quality installation of in-home wiring. Some of the problems associated with in-home wiring include signal leakage and customer/contractor education.

"Right now," says Nelson, "We are in need of operator input—that's who will ultimately be affected."

EIA/NCTA joint subcommittee

Chairman, Walt Ciciora: Work continues as this group continues to build a stronger bridge between the cable television and consumer electronics industries. Currently, several projects crowd the plate, including research into an interactive program guide (television modification needed), the ongoing battle to eliminate (or at least lessen) direct pickup interference in television receivers, and usage of the vertical blanking interval.

Standards subcommittee

Co-chairmen, Dick Shimp and Bert Henshied. In an effort to update the NCTA's *Recommended Practices for Measurements on Cable Television Systems* publication, this group is gathering data for the next published update. "We're collecting input on subjects such as distortion levels, composite triple beat (CTB) and carrier-to-noise (C/N) values," says Shimp. The group is also focusing efforts on fiber optic measurements, to be published in the next edition, Shimp says.

—Leslie Ellis

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The fog of technology

In previous years, the National Cable Show was the one convention an outsider could attend to get a clear understanding of what the cable industry had to offer and where it was headed technologically. However, new technological developments were in such abundance that the heads of those who attended Cable '91 in New Orleans are probably still spinning from information overload.

Evidence that technology marches on at a dizzying pace was omnipresent during the three-day confab, which was dominated by technology issues. But while it was clear science is moving rapidly, it was difficult to make sense of it all and plot a course to CATV's long-term future. In fact, many believed technology was *diverging*, not coming together in one grand scheme.

For the first time in years, the '91 National Show won't be remembered as the "fiber optics show." Instead, several new themes were sounded: Video compression and its implications on channel capacity and pay-per-view; interdiction and its associated consumer-friendly features; personal communications networks and the ramifications on the telco/cable political debate; and the debut of 1 gigahertz RF devices.

Certainly the most eyebrow-raising new technology shown was digital compression. Skypix demonstrated its scheme in the Home Shopping Network booth (Skypix just received a financial shot in the arm from a joint venture with HSN) and Jerrold had its Digicable equipment on hand for a live feed. Scientific-Atlanta also demonstrated its B-MAC satellite compression method by showing a tape of high definition.

While many marveled at how far compression has come in a scant 12 months, others were busy planning applications. With video compression, programmers can significantly reduce their expenditures for transponders (or alternatively offer more channels to the consumer); operators can expand channel capacity without rebuilding plant; PPV lineups can be expanded to offer movie start times much more frequently; and the full benefit of fiber optics can begin to be explored.

Skypix used the local Cox cable system and uplinked video from a GTE facility in Connecticut through Hughes SBS 6 medium-power Ku-band satellite to deliver the pictures. It is the same system that was tested in Rock Associates' Coeur d'Alene, Idaho system earlier this year. Despite problems raising capital, Skypix officials say the DBS service will be launched this summer.

Skypix's direct broadcast satellite (DBS) equipment

By the time the convention closed, Skypix/HSN and Jones Intercable Chairman Glenn Jones had reached agreement to test a new digital/analog receiver by early 1992 (Skypix's receiver is presently all-digital). Jones said that financial funding was not part of the agreement, but hinted that further discussions may be forthcoming.

Generally high marks were given to Skypix's 8-to-1 and Jerrold's 10-to-1 live compressed feeds, although some video artifacts were present and visible to the well-trained eye. However, the artifacts were short-lived and hardly annoying, standing up to even the most intense scrutiny by expert viewers.

Cable Television Laboratories hosted a press conference to reiterate the importance of compression in cable's long-term strategy. Representatives from Jerrold and S-A were also on hand to talk about the consortium that has been created to expedite compression's implementation.

Dr. John Malone, chairman of TCI, told the standing-room only crowd that new services will "explode" on the scene because of compression's ability to lower the start-up costs. He said he expects a "Chinese menu" of programming to erupt to fill the "programming void" between inexpensive basic and pricey premium services.

CableLabs CEO Richard Green said the Labs' Technical Advisory Committee would pursue an "open architecture" to allow for multiple compression vendors. Presently, none of the systems can be interconnected.

Scientific-Atlanta made a splash presentation of its new digital compression scheme, based on vector quantization, that provides headend quality video compression of full-motion video in real time. S-A officials were reluctant to discuss how much the headend decoding equipment would cost, but said it would be made available in about a year. Sometime after that, S-A will build equipment to send compressed digital video to the home.

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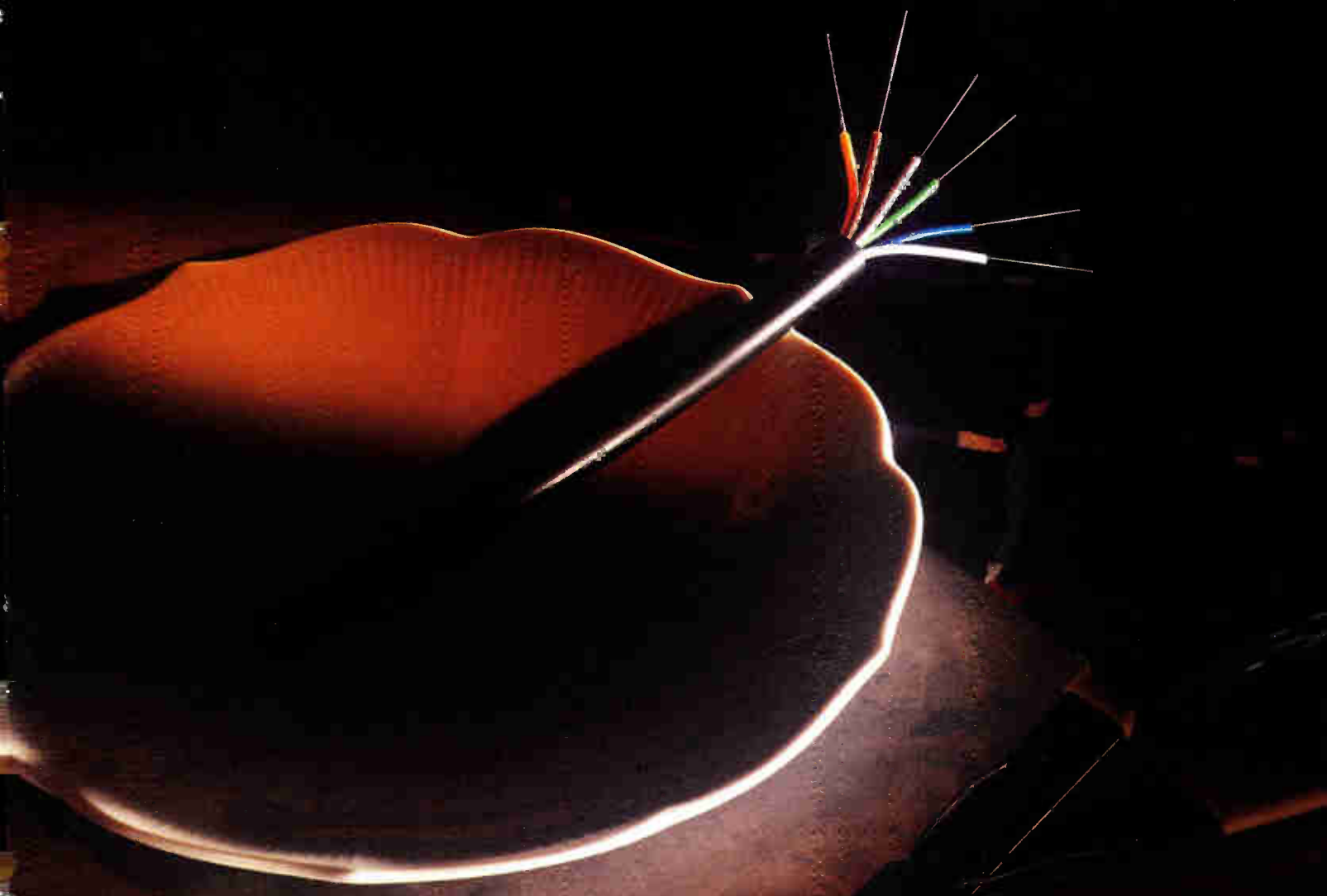

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Reader Service Number 13

Moving to the light ages

Fiber optics is a tool that allows cable operators to "move from the dark ages to the light ages," according to Alex Best, vice president of engineering and technology for Cox Cable, who opened the session on Fiber Optics Performance held during the National Show in New Orleans.

After speaking of "the promise of new business" fiber optics offers to the cable industry, Best introduced Ed Callahan, vice president of technology for Anixter Technologies (Antec). Callahan, who co-authored the paper with Donald Bishop, also of Antec, addressed the issue of "Measurement Anomalies in Broadband AM-VSB Systems."

Because of the "sizable deployment" of fiber optic technology, Callahan sees the industry in a mode of intensive product evaluations and cost/performance trade-off reviews. Because of this, Callahan sees the need to look at the several sources of measurement anomalies in order to obtain meaningful and reproducible results. To Callahan, competition in the home video market has heightened quality questions concerning cable, with fiber optics being the technology to address these issues.

Callahan went on to discuss the impact of a spectrum analyzer's frequency response, the effects of amplitude measurement inaccuracy, the effects of external bandpass filters, impedance related problems and automated measurements. Here Callahan cautioned about the use of automated measurements, saying they can and should be used, but that "they can be inaccurate."

In summary, Callahan stated that all measurements include uncertainties. Even with the "best efforts applied," the window of uncertainty is roughly 2 dB, and is independent of the test methodology used. In a final statement, Callahan said "all of us are subject to uncertainties, a proper perspective must be maintained toward test data."

Fiber design considerations

John Chamberlain, fiber optics product manager for Comm/Scope Inc., addressed "Fiber Optic Cable Designs Advantages and Disadvantages." Chamberlain stated that his desire was to help with questions on fiber optics and how it works. Because of the different fiber optics being offered to the cable industry, Chamberlain first looked at design considerations and addressed mechanical and environmental factors.

Noting that the first concern of the cable designer is to protect the glass fiber from outside environments, Chamberlain spoke of temperature ranges and its effect on the fiber. "Low temperature is the concern," says Chamberlain. Because of the difference in coefficients of expansion, the "cable shrinks like crazy and the fiber doesn't."

Chamberlain then discussed the various specifications designed to assimilate environmental concerns. Saying the tests were rigorous, he discussed the impact test; compressive loading; cycle flexing; cold bend; tensile loading and elongation; sandbox test; and gopher test. Chamberlain also discussed the various types of fiber but focused on the two most common to the cable industry: loose tube and central core.

"Both cables perform basically the same," says Chamberlain. "Other than minute differences, it comes down to handling practices and personal preference in the final decision."

Optical bridgers discussed

Donald Raskin, vice president of engineering with the communication products division of Texscan Corp., began the next paper on "AM Optical Bridger Networks for CATV," saying that fiber to the feeder (FTF) and fiber to the bridger (FTB) are more common terms than optical bridger but they were all the same. (The paper was co-authored by Scott Loder and Ronald Oberloh, also with Texscan.) Raskin focused on the architecture and its implications for the cable industry.

Beginning with a history of the backbone concept, Raskin said he could see how it evolved to FTF. The previous networks were good but did not save money. "Is there a way to get more widespread use but also be cost effective?" questioned Raskin. With this in mind, Raskin went on to discuss both four-amplifier and five-amplifier optical bridger networks and the reasons for their cost-effectiveness.

Fiber's cost-effectiveness

Taking one sample system design for a 90 sub/mile operator, Raskin said nearly 25 miles of plant (2,200 subs) could be served from a single optical bridger node with 50 dB CNR, 53 dB CTB and 59 dB CSO at the tap. The cost (not including cable and installation) would be $7 per sub vs. the $20 per sub coaxial cost.

Raskin finished his paper with a discussion of amplifier hybrids and the use of feedforward (FF) technology for the amplifiers. He said FF technology costs more, has a longer reach in a straight-line with a single string and that automatic gain control is needed (an option with power doubling technology).

Finally, Louis Williamson, technical staff member for ATC, focused on the "Impact of Dispersion on Analog Video Transmission." Williamson, who authored the paper with Douglas Wolfe of Corning Inc., started by speaking of industry discussions of 1310 nm wavelengths vs. using a 1550 nm window. "Is 1550 the wavelenth of the future?" asked Williamson.

Because there is less loss at 1550 nm, there is an advantage to using the window for increased transmission distances or splitting capabilities. One very important driver of the 1550 window, says Williamson, is optical amplifiers. Another reason for 1550 usage is the industry "will run out of capacity at 1310. We would like to do wave division multiplexing (WDM)," says Williamson.

Unfortunately, 1550 windows also have more dispersion. At 1310 nm, continued Williamson, singlemode fibers are designed to have zero dispersion. That dispersion increases with wavelength because of changes in the fiber material index of refraction. Here, Williamson asked "what is the best fiber to put in? Whatever you want," he answered. (As the wavelength of the laser increases, there is an increase in the delay caused by the fiber. The causes of this delay distortion is laser chirp and fiber dispersion.)

There are several solutions to the dispersion problem, says Williamson. They include: delay compensation; octave bandwidths (with WDM, operators can use 1550 nm lasers and extend bandwidth); dispersion shifted fiber; alternate modulation formats; external laser modulation; and improved laser technology. Williamson concluded by saying there are problems associated with using 1550 nm on standard fiber, but there are also many methods for dealing with the problems. "Which wavelength wins is purely an economic choice," says Williamson, "and not which is the better one." ■

—Kathy Berlin

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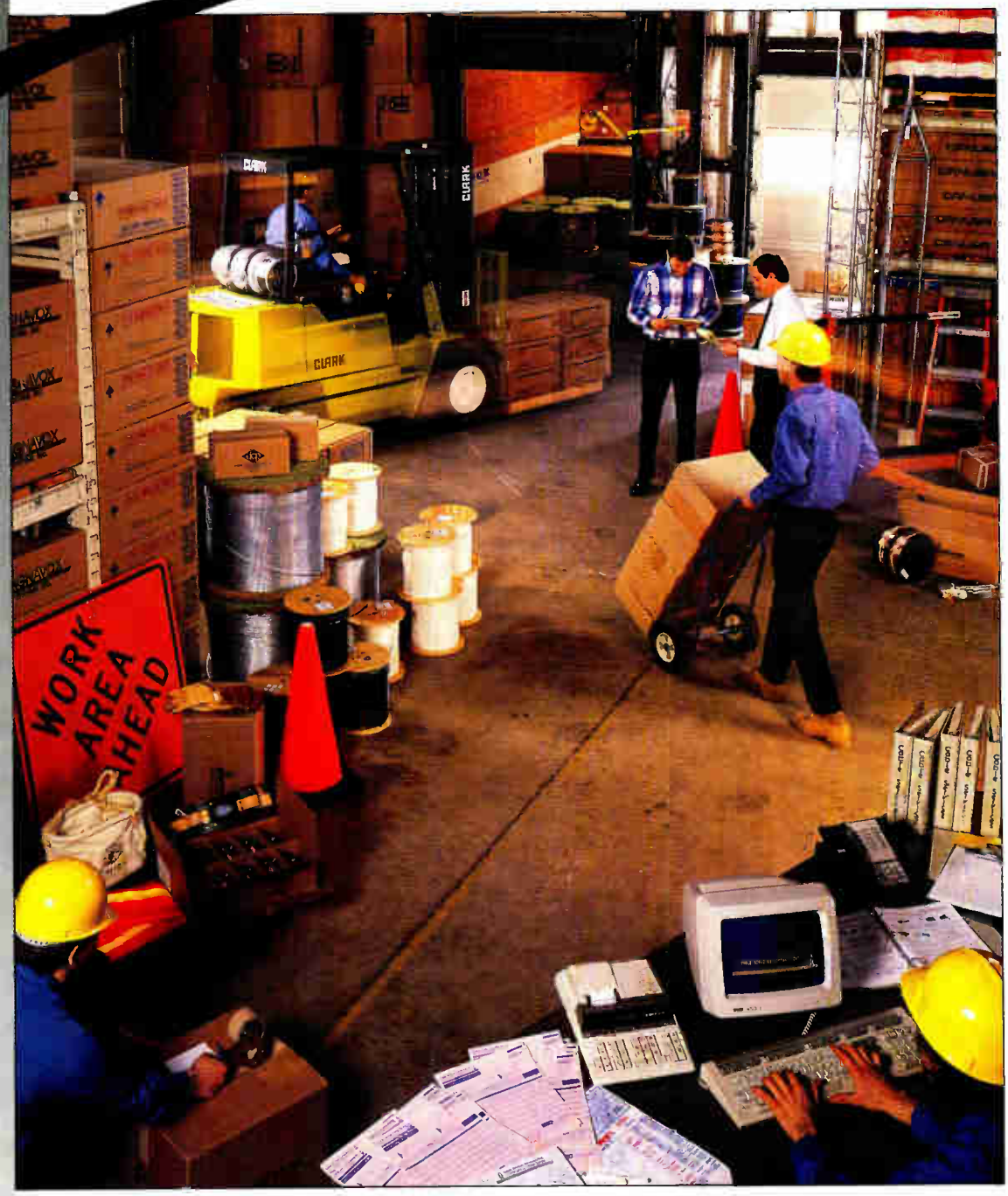

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Reader Service Number 14

tion video, S-A has joined with Captain New York Inc. to establish the first commercial HDTV production/transmission facility in North America, it was announced during the show. The system is set for June installation at the Ed Sullivan Theater in New York City. The facility will utilize S-A's HDB-MAC equipment.

Off-premise, round 2

A handful of new interdiction devices also showed up in New Orleans, creating a second wave of excitement regarding outdoor addressability (the first wave came nearly a decade ago). Joining S-A and Jerrold with interdictive plans were Zenith/AM Communications, Magnavox/Oak Communications and Regal (Midwest CATV, Eagle, Blonder-Tongue and Electroline offer addressable trap devices).

Zenith's new "Port Authority" unit is based on AM's Tier Guard technology, which emerged in 1984 and is running in eight cable systems. Zenith touted its system's low cost, noting that it would sell for about one-third as much as other systems, making the per-subscriber cost equal or slightly less than addressable set-top units. Port Authority can be configured for home or plant powering and is co-located with the tap.

A joint agreement between Magnavox and Oak have married Magnavox's AXIS (addressable external interdiction system) and Oak's ACS (addressable control system) to give both companies a new interdiction product with second-sourcing. The AXIS system can secure up to 72 channels by utilizing 16 oscillators (operators can choose to purchase four, eight, 12 or 16 oscillators per housing) and the level of masking can be locally controlled.

AXIS is available in four- and single-port offerings. The units can be strand, pole, pedestal or house mounted. It is slated to be tested this spring and manufactured in early 1992. It will be priced comparably to set-top addressable descramblers.

Meanwhile, Regal displayed its long-promised system as a single dwelling unit device designed for side of home mounting. However, it too will be available in pole-, pedestal- or strand-mount versions. The system operates to 550 MHz and can mask signals between 50 MHz and 450 MHz.

And finally, Nexus Engineering showed it's spanking-new Sub-Manager interdiction system that can be configured as a simple tap on/off controller to full control of multiple channel tiers. In an MDU configuration that offers on/off control and their tiers, the system would cost about $100 per passing; the device designed for single dwellings has 16 ports per device and costs $30 to $40 per tap in its simplest configuration, said Nexus officials.

Also, Eagle Comtronics showed its new "Sideband Interdiction System" positive trap-type device. According to Eagle officials, any number of channels may be scrambled at the transmission site by a new IF scrambler. Channels are then decoded at the subscriber's home by a passive device resembling a positive trap.

Unlike conventional positive traps, however, this device is said to operate to 450 MHz and beyond with little or no video degradation. Even adjacent channels are not affected, said Eagle officials.

Through it all, cable engineers seemed confused about the trade-offs between the consumer friendliness of interdiction and the need for an in-home decoder for digital video compression. If a system embraces interdiction, how will that affect compressed signals? Can operators afford to essentially invest twice for conditional access devices?

However, vendors were quick to point out that the two technologies actually complement one another and can co-exist. But, the unanswered question is can operators extract enough revenue from subscribers to pay for both technologies or will the looming presence of compression stifle interdiction purchases? Even the vendors don't seem to have an answer for that.

Another conflict that video compression presents relates to the quest for greater bandwidth. While some systems could follow Time-Warner's lead and build 1-GHz systems capable of delivering 150 channels, others may wait for compression and avoid the need for expensive RF equipment to get to the 1 GHz plateau.

However, C-Cor Electronics announced development of a wideband 1-GHz gain block, making it the first out of the gate with such a product. While the device wasn't ready in time for display in New Orleans (engineers were feverishly working to reduce the size of the package), Bob Beaury, director of marketing, said C-Cor was actively pursuing ATC's business and said product would be available when ATC needed it.

Also from C-Cor, engineers in conjunction with Rogers Cablesystems and Adelphia Communications introduced a new networked concept dubbed "flexible networking." Following on the heels of last year's FTF architecture, the new 'flexible' concept is built around the cost ("keep it low") objectives of today's cable operators. It also lends well to future PCN or video on demand services, says C-Cor's Bob Beaury, director of marketing.

Three main principles embody C-Cor's network vision: Home run fiber paths, neutral RF mini-trunk networking and superdistribution feeders. Home run fiber paths "allow for easy upgrade of the AM fiber portion of the plant, while also allowing the use of 1550 nm and optical amplifier products as they are developed," Beaury explains. Where traditional fiber architectures split the fiber some distance from the headend, the home run fiber path locates the fiber optic splitters at the headend and dedicates a home run fiber path from the headend to each receiver.

The result is a system that "reduces reconfiguration time, simplifies fiber additions and establishes subscriber segmentation"—a key to video and demand and PCN, Beaury says. The incremental cost to implement the home run fiber path is "less than one percent."

The second leg of C-Cor's flexible architecture, the "neutral network" provision for RF minitrunks, is a partial brainchild of Adelphia Communications and uses existing plant design while allowing for strategic placement of new fiber nodes. In doing so, the design permits different fiber architectures to coexist within the same system. As for cost, the incremental cost is "less than two percent," says Beaury.

The last portion of the flexible network architecture, "superdistribution," lessens cascading of amplifiers and taps and reduces the number of high level output amps in cascade. "Superdistribution," explains Beaury, "improves system performance and reliability by reducing the number of devices between the headend and the subscriber." The design also accommodates "drop in" upgrades of feeder to expand the bandwidth to 1 GHz. The incremental cost is "less than five percent."

"Combined, the incremental cost to build a flexible network system, then, is under eight percent," Beaury

concluded. In conjunction with C-Cor's new design concept, the company released a plethora of new products, including an AM fiber optic receiver, nine minitrunk amplifiers, and a 1.5 Gb/s optical terminal.

Passive devices designed for higher frequencies also made their debut. Anixter Cable TV unveiled the initial design of a complete 1 GHz integrated drop system, including products manufactured by Raychem, Regal, Comm/Scope and Sachs. The system standardizes all drop components to improve reliability and help insure signal integrity.

Regal's line of new 1 GHz gear includes splitters, multitaps and line passives which use microstrip printed circuit board technology. The full line of equipment will be available by the second quarter of 1991, according to Steve Necessary, the newly named president of Regal. Necessary came to Regal from Scientific-Atlanta, where he was employed for nine years, most recently as vice president of marketing for subscriber systems. As a result, the Regal corporate headquarters will be moved from Chicago to Atlanta.

Also, equipment aimed at the "intermediate" frequencies of 750 MHz and 860 MHz were on hand. Magnavox again demonstrated its 750 MHz amplifiers and passives. Meanwhile, Pioneer, Panasonic and others showed converters designed to tune 110 channels and noted they were ready to produce the devices when operator demand emerges.

> For the first time in years, the '91 National Show won't be remembered as the 'fiber optics show.'

Fiber matures

With all of the above garnering headlines, significant developments in the now-maturing fiber optics industry were overshadowed. Fiber vendors seemed to be busy assuring engineers that there is no need to debate the merits of 1550 nm equipment vs. 1310 nm gear. CableLabs, prior to the convention, examined the issue and determined there is no detriment to either approach and that solutions for the dispersion problem at 1550 were at hand.

Consequently, numerous operating erbium doped fiber amplifiers, designed for use at 1550 nm, were shown on the floor. Whereas only one was present in Anaheim at the Western Cable Show last November, at least a handful of working EDFAs were exhibited by Jerrold, Synchronous Communications, American Lightwave Systems, Scientific-Atlanta and others.

Considering the company's relative small size, many observers were surprised that ALS is developing its own CATV-specific 1550 optical amp. But when it's understood that ADC Telecommunications is ALS' parent company, the surprise quickly dwindles. ALS' development project is being coordinated with C-Cor Electronics, which has a marketing agreement with ALS. According to John Holobinko of ALS, the project should result in a more

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Reader Service Number 15

How good is good?

Attendees at last year's Western Cable Show in Anaheim were, surprisingly, 3 dB less sensitive to picture impairments than non-expert participants in a Horsham, Penn.-based series of formal tests. This ironic news was part of a technical presentation by independent auditory and visual perception expert Bronwen Lindsay Jones, who presented her findings at the NCTA's Picture Quality session in New Orleans last month.

"This is probably because of the casual nature of the tests," Jones explained. "When we performed the more than 32 hours of tests at Jerrold, the participants were rigorously 'prepped.' Also, their eyes had a longer period of time to adjust to the different light. That wasn't the case in Anaheim."

Other participants in the session, moderated by the Advanced Television Test Center's Brian James, presented topics including Jerrold Communications' series of subjective video impairment tests, the interpretation of those tests, chrominance/luminance measurement methods, and ghost cancelling experiments.

Jerrold test laboratory

Joseph Waltrich, manager of analog programs and the Applied Media Lab at Jerrold Communications, kicked off the session with his presentation detailing the Horsham-based test laboratory. "We built a cable system emulator for determining current and future system thresholds," Waltrich explained. The tests were conducted by injecting a series of impairments into a laser disc video source that was fed through a four-amplifier cascade. Impairments included chroma-luminance delay, phase noise generation, microreflections and random noise.

An automated control system tracked the impairments either manually (for expert viewers, to determine tolerance thresholds) or automatically (for non-expert viewers). Test participants used an automated remote control which tracked viewing opinions on a scale from "imperceptible" to "annoying" and reported the data back to the central diagnostic processor. The non-expert viewing thresholds were as follows:

- Random noise: 50 dB to 53 dB
- Phase noise: -92 dBc/Hz to -93 dBc/Hz
- Composite Triple Beat: -51 dB to -53 dB
- Chroma-luminance delay: 100 nS to 200 nS
- Microreflections: -12 dB at 58 nS; -17 dB at 116 nS.

Following Waltrich and describing the implications of the test was Jones, who detailed the results of the expert and non-expert level tests. "Interestingly, the thresholds (imperceptible and annoying) remained the same for the expert and non-expert viewers—an expert may hang in for an extra dB or so, but that's it." Jones is an expert on internationally recognized test reference standards, including lighting methods and even correct chair placement within the test studio.

Jones closed her presentation with a slide depicting picture quality expectations from 1958 to 1990. "There seems to be a pattern in that the public's picture quality expectations raise about 5 dB every 10 or so years," Jones commented.

Scientific-Atlanta's Blair Schodowski, a senior engineer for the company, continued the session with a presentation of his paper titled "Measurement differences with various chrominance to luminance gain and phase techniques." Starting off with an explanation of the difference between chroma-luminance gain and delay, Schodowski explained that "chroma-luminance gain is the difference in gain between chrominance and luminance, and results in an incorrect color saturation. Chroma-luminance delay, on the other hand, is the difference in gain between chrominance and luminance, and manifests itself as color smearing."

> 'There seems to be a pattern in that the public's picture quality expectations raise about 5 dB every 10 or so years.'

Schodowski continued with three different test methods, including the more common 12.5T Sin^2 pulse, which uses waveform and mathematical analysis; the sin x/x pulse, which analyzes complete frequency response; and a multiburst technique.

Busting multipath ghosts

Rounding out the session was Rogers Cablesystem's VP of engineering and technical services Nick Hamilton-Piercy, who provided an update on the system's ghost cancelling tests. "We've tried just about everything," Hamilton-Piercy chuckled, "The old bucking antennas with attenuators, RF cancelling schemes, and baseband cancelling. Unfortunately, they all proved inappropriate over time."

Rogers' Salt Spring Island site (near Seattle) has suffered the most from the bothersome multipath ghosts, Hamilton-Piercy continued, because of a combination of mountains and Seattle's skyscrapers. So, Rogers embarked on a comprehensive test of newer ghost cancelling technologies, including several sin x/x versions and a technical review of a pseudorandom sequence (see *CED*, February 1991 p.27 for more information on current ghost cancelling tests).

Toshiba, JVC, NEC and Sony were among the ghost cancelling technologies evaluated. All are NTSC-based and utilize sin x/x waveform design (also known in engineering circles as the "BTA version," for the Broadcast Technology Association of Japan.) Commenting on the sin x/x technology, Hamilton-Piercy attested that it "would probably be a disaster in rapidly changing multipath or television environments with a rabbit-type antenna."

Regardless, the four units tested work "very well," says Hamilton-Piercy. The company's next experiment is to move the cancellers deeper into the system—"through AML hubs, after amplifiers"—to see how useful they are for cable television microreflections and in general, to see their effects.

In a lively question and answer exchange after the session, however, one National Show attendee posed the following question: "Are we (cable operators) just fiddling around with these band-aid solutions when we really ought to be demanding a direct feed from broadcasters?" Hamilton-Piercy was quick to respond—"Absolutely. Yes. Especially in light of digital and HDTV formats." In fact, ghost cancelling is among the tests slated to be performed on the forthcoming HDTV equipment later this summer—and promises to be a topic of discussion for months to come. ■

—Leslie Ellis

cost-effective amp for CATV companies.

Synchronous showed a glimpse of the future by wave division multiplexing analog video over both 1550 and 1310 operating windows and tacking on digitally modulated signals at the top. The 1550 signals were boosted via an EDFA, which probably is at least six months from commercial reality, according to Hermann Gysel, vice president of engineering. The Synchronous EDFA is available in 10-, 13- and 15-dBm output powers.

Other fiber gear that made its debut in New Orleans included ALS' new strand-mounted receiver that supports CATV networks delivering up to 1 GHz of bandwidth. The LiteAMp FX ("Flexible Transport") series is being designed to serve subscriber "cells" and reportedly offers savings by reducing the cost of the coaxial portion of the network.

The receiver can be configured with up to four high-level (48 dBmV) bridger outputs, making it ideal for use with "minitrunk" type RF amplifiers. A fifth output is available at trunk level to serve a nearby pocket of homes. The new receiver and amplifier is just part of the ALS LiteNET "toolbox," which includes switching and management equipment from ADC.

Orchard Communications brought a new, improved externally modulated laser to the convention. The new device builds on existing equipment with higher launch power (15 milliwatts from each of two ports) and reduced distortion numbers (-70 dBc). The system can transmit 80 channels over a single fiber using pump YAG lasers and external modulation.

The Orchard laser was also shown in the Magnavox booth, where it was paired with Magnavox's MagnaHub Optical Mainstation (Magnavox and Orchard inked a marketing and distribution agreement late last year). Also featured by Magnavox was a new dual-output bridger designed for high-density builds. It offers 6 dB better performance for fixed station output levels and up to 14 dB more system reach for fixed performance levels.

And almost as an aside, Magnavox unveiled its new ghost elimination technology, slugged the Video Echo Eliminator. Designed to lessen the effects of multipath ghosts in cable systems, the Video Echo Eliminator boasts a 0.05 second convergence time. Currently equipped for NTSC ghosts and utilizing sin x/x technology, Magnavox's ghost canceller is slated to be adapted to HDTV in the near future. The equipment comes as welcome news to cable operators battling the effects of the annoying multipath video effects that occur when signals bounce off high-rise buildings, mountains or other objects.

For its part, Texscan unveiled a new transmitter and receiver for use in its "Flamethrower" hybrid fiber/RF system. The TLT-4000 transmitter (available in both 1310 and 1550 nm versions) delivers 40, 60 or 77 channels over a single fiber and offers digital status display and status monitoring functions. The new "low-cost" receiver accepts multiple plug-in receive options as well as return laser capabilities. The "Glas-PAL" device is said to improve economics of fiber systems domestically as well as serve the European needs.

Lastly, Texscan showed a new AGC/ASC version of its PAL line extender. This unit will share a common plug-in control card with the Flamethrower family of optical bridgers, distribution amps and mini-trunk stations.

Meanwhile, Antec, through sister companies Anixter Cable TV, Optical

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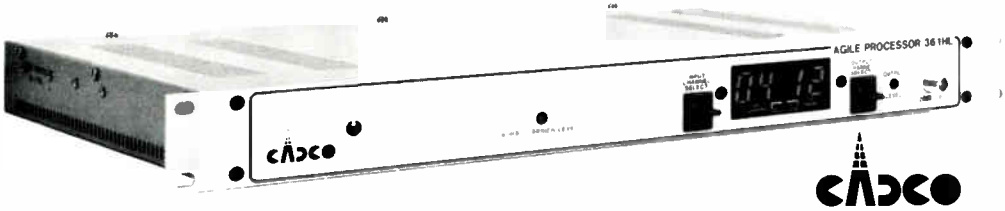

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Networks International and Regal Technologies, showed off the considerable resources of its relationship with AT&T. The group unveiled an architecture designed to include personal communications networks and video compression. The complete "communications infrastructure" is backed by AT&T equipment, including alternate business access transmission and termination systems, Laser Link equipment and SONET multiplexers and cross connects.

Word had it that AT&T (via ONI) will join Jerrold and S-A as cable suppliers offering a digital video compression scheme. Observers said that development isn't surprising considering AT&T is joined at the hip with Zenith for the latter's HDTV transmission method.

Finally, ONI introduced its "Restorpak," a restoration kit designed to reduce outage time during emergency fiber breaks. The kit consists of two portable cases and supplies all the tools and components necessary to restore a fiber break. The kit is available in one-, two- or four-person applications.

Fiber party latecomer Panasonic plans to offer 40- and 80-channel per fiber AM systems using DFB lasers beginning in June, according to Jim Slade, Panasonic marketing director. The system will offer many of the features presently found in other systems and perform at levels acceptable to cable operators, Slade said.

Vyvx NVN again attended the National Show, showing cable operators the capabilities of the nationwide DS-3 digital network offering switched, broadcast-quality video. The most immediate application is to use the network to backhaul regional news and sports programming, but Vyvx expects other applications to come to the fore.

Not to be outdone, S-A developed and showed a new family of amplifier products, available in both single- and dual-output versions, designed to support the company's "Fiber to the Serving Area" concept.

Set-top friendliness

The single-output model is an improved version of S-A's current distribution amp and is used in combination with the dual-output model, which provides high-level outputs (3 dB to 4 dB better) to improve system reach with fewer amps.

Vyvx's NVM system being installed through decommissioned pipelines

Moving to the more-traditional RF distribution and subscriber terminal gear, vendors continued their efforts to improve the interface with consumers and consumer electronics. They also

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Premature coax cable failure in the Sudbury, Ontario area used to be commonplace because of the weather extremes. Abrupt 12-hour 60°F temperature swings in the Spring and Fall. Winter lows to -40°F and Summer highs in the 90's. Blizzards, freezing rain and average daily winds of 16 mph with gusts exceeding 50 mph. These severe conditions kept maintenance crews busy repairing or replacing sections of cable that may have been installed only months before.

Denis Coté, Service/Plant Maintenance Supervisor for Northern Cable Services, and lineman, Wayne Minor, knew these problems firsthand. But, since they installed their first section of Quantum Reach back in 1984, they have been smiling from ear to ear. That's because QR cured their cable failure problems. They've seen how QR's unique design makes it lightweight and easy to handle yet strong enough to outperform any other cable. "Nothing works like Quantum Reach," they say with good reason.

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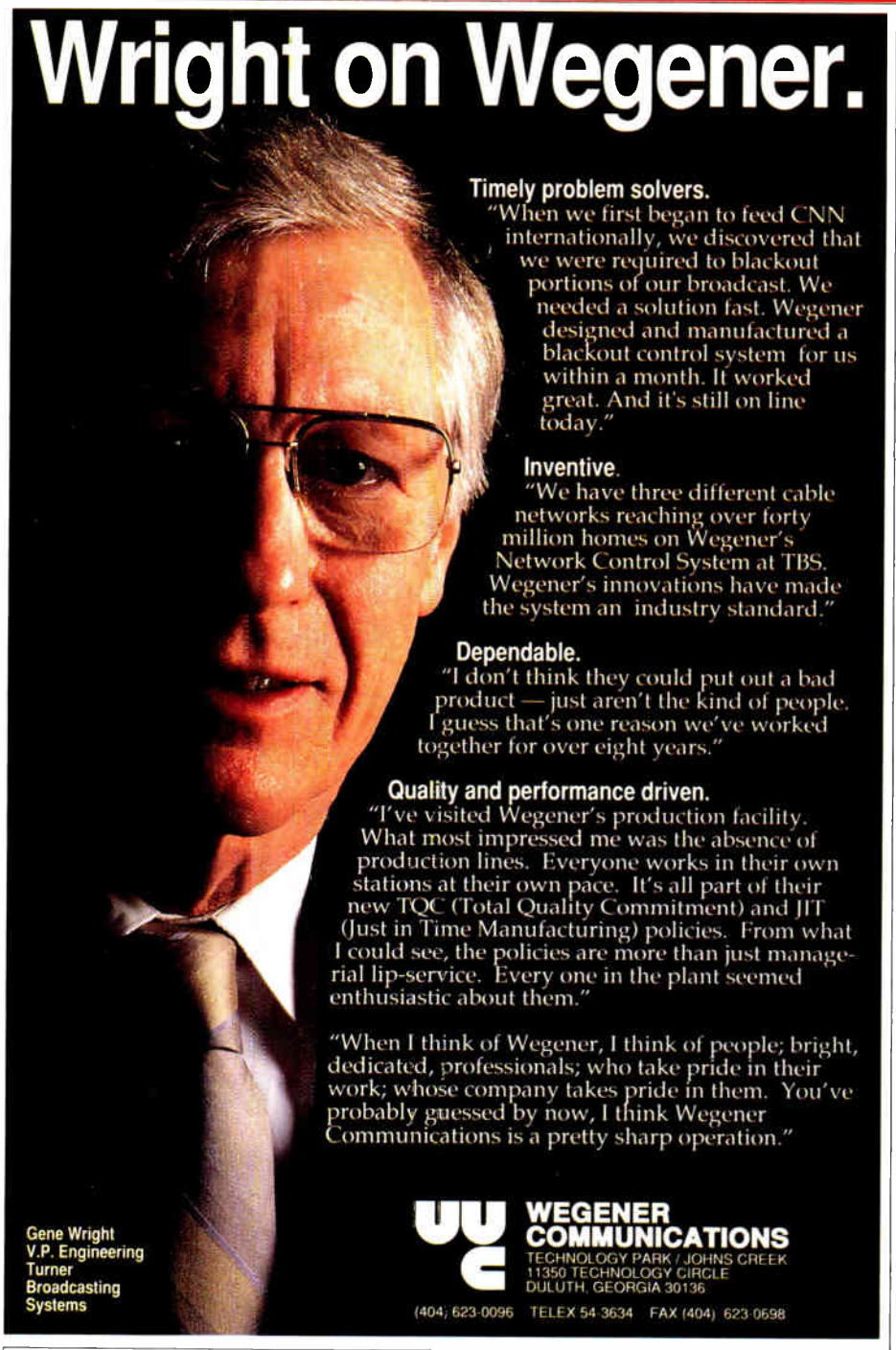

talked of low-priced addressable methods of offering the upcoming 1992 Olympics, planned for PPV distribution.

Jerrold and S-A have both improved the on-screen menu features in their converters, and private conversations with Zenith and Pioneer revealed that similar features will appear in those boxes shortly. Panasonic quietly took operators to a hidden room in its booth and showed off its first addressable unit, which is presently being field tested in a Jerrold system in the Northeast. The Jerrold-compatible descrambler, planned for August roll-out, will support impulse PPV, offer volume control and on-screen displays, said Slade.

As expected, Jerrold and Zenith announced agreements with NBC to provide low-cost addressable devices to accommodate the 1992 Olympic Games. Combined with the three-channel trap designed by Arcom, cable operators can now opt for traditional trap-based security, low-cost addressability or a full upgrade to conventional addressability.

The approach Jerrold took was to build a new, three-channel decoder, called the Olympian 2000. Expected to sell for about $70, this approach was designed for operators who want an inexpensive way to offer addressability and pay the hardware off quickly. Zenith, on the other hand, went the sidecar route, reconfiguring its Paymaster add-on unit (which sells in the mid-$30 range) for use with the NBC feeds.

PCNs make intro

Although interest in PCNs has stirred up plenty of interest among operators, little in the way of hardware was shown in New Orleans, with the exception of a PCN-type demonstration in the Nexus Engineering and Jerrold booths. Those two firms, which have inked a development agreement with CableLabs, each had working telephone handsets and "microcell" receive sites linked via coaxial cable.

Nexus and Jerrold (as well as others) are developing experimental interface hardware aimed at adapting PCN gear for use over the CATV plant. The agreement with CableLabs calls for information sharing to determine the technical and economic feasibility of such networks.

A few more bites...

Alpha Technologies has added a 7.5 KVA version to its line of uninterruptible and announced that 10 KVA and 15 KVA units are nearing completion. The company reports that cable systems are relying on UPS devices to maintain PPV functions, automated answering equipment, telemarketing systems, and more to improve customer service.

Comm/Scope Inc. nailed down an agreement with AT&T to manufacture fiber optic cable under license. Comm/Scope's Optical Reach fiber cable will be available in 1991 through a private label agreement then will be manufactured by Comm/Scope beginning next year.

ConTec International is now guaranteeing a 3 percent or less out-of-box converter failure rate on all its descrambler repairs. In order to gain marketshare the company lost over the past several years, a $10 cash rebate will be paid for all returns above 3 percent, company officials said.

Oak Communications celebrated its rebirth with an "alumni" party and

showed a new RF return option for its Sigma addressable decoder. This feature supports impulse PPV and provides the capability for tracking a variety of system statistics and functions. The system can poll converters at speeds approaching 100,000 boxes a minute, according to Tony Wechselberger, senior vice president.

And finally **Regal Technologies** introduced a line of isolators to serve the U.K. and European market. Also, Regal showed a new residential wiring system built by Square D that integrates telephone, video and audio services. The ELAN system is designed for new homes and gives virtually every room access to cable, VCR and telephone signals.

Other new products

Audio Rider unveiled the Audio Rider 1000, an audio level monitoring system that monitors and logs audio level variations of all headend channels and displays the information in video or printed forms. The information can then be used by technicians to systematically adjust audio source/modulator settings or identify channels which need attention.

The system includes a rack-mounted computer and color monitor and connects to the subscriber signal (or test point). The Audio Rider 1000 can be permanently located at a single headend, or used as a test instrument between several headends. The unit is upgradeable to the Audio Rider 2000 audio management system.

Budco showed a new seven-inch telephone enclosure tool which fits a 5/32 inch pin socket head cap screw, has a large handle for tightening and loosening is made of high carbon steel. Also available from Budco are a Can and Torque wrench. The Can wrench features a sure-grip handle combining a 3/8 inch and 7/16 inch socket on each end; usage for opening pedestals; and an approximate length of seven inches. The Torque wrench is for use on 7/16 inch hex fittings and 5-45 inch/pounds of torque. Finally, Budco showed a terminating tool designed for Viewsonics' TRW-RLT terminator. The tool is made from high carbon steel with hardened tips and can be used in ports with traps.

Channelmatic has included its error detection technology as a standard feature (as opposed to an option, which it was previously) of its Adcart Random Access insertion systems. Once integrated, Adcart will monitor all channel control units within a system and detect any of three errors: VCR failures, cue tone failures, or other occurances that cause a channel to stop inserting commercials. If an error is detected, the error detection module dials a pre-determined pager number to alert the operator.

Also announced by Channelmatic is its new V:base, a tape library management software program developed for use with the CompEdit 600A videotape compiling/editing system. V:Base tracks library and spot reels in inventory, stores traffic and billing information on each spot and performs library and task management functions. Also included is the capability to visually browse through the contents of any master spot reel on a personal computer, and modify its contents before made into a physical tape. The software is menu-driven and offers on-line help screens.

BTSC Encoder Update

BTSC Encoder performance and reliability.
"A few years ago, we selected Wegener's BTSC encoder over eight other manufacturers' encoders because we believed they offered the best performance. We've now had over 160 of Wegener's BTSC encoders on-line for the past three years, and I can't recall us having much trouble with any of them. We had no idea that encoders could be as reliable as Wegener's have been."

Dependable support.
"We also had no idea that Wegener's support service would be so dependable. Years after installation, they still meet our support needs. That kind of support is invaluable when training new headend technicians who are still learning proper headend procedures."

Audio AGC performance.
"Recently, we installed a number of audio AGC boards on channels that are switched between multiple sources and/or carry local commercial insertions. They've performed exceptionally well. And they've reduced customer complaints about varying audio levels to virtually zero."

"Over the years, I'd say Wegener has been building more than fine products; they've been building a reputation."

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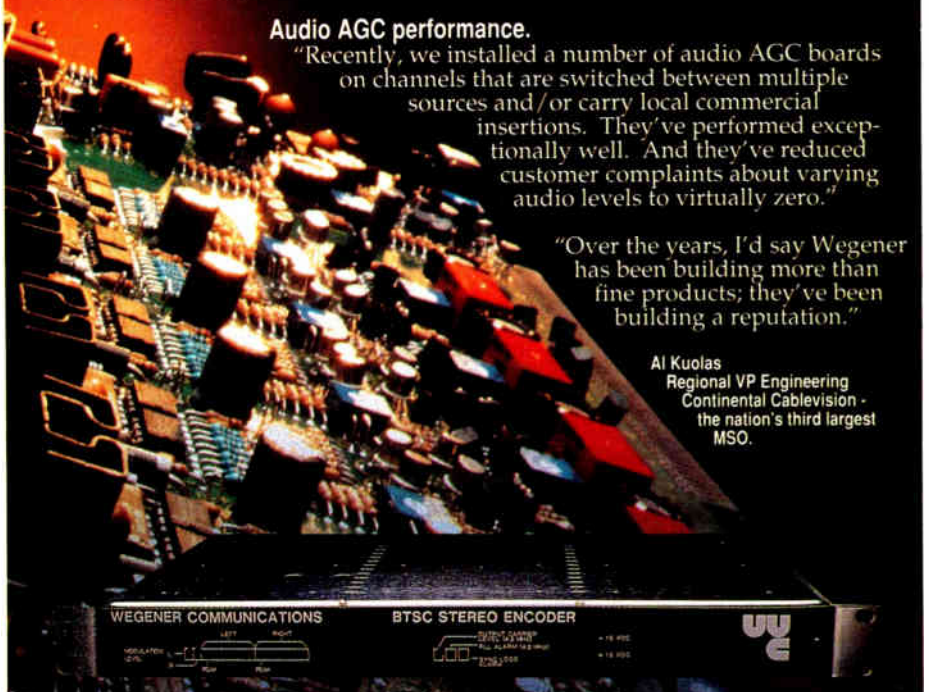

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Reader Service Number 21

Compression technology draws crowds

In a standing-room only technical session at the National Show, Walt Ciciora, vice president of technology for ATC, began the papers, saying he "had not seen such a well-attended session since the days of videotext." His paper, "Scenarios for Compressed Video in Cable Practice" addressed possible scenarios as well as the role of fiber and alternative approaches.

Video compression leaves operators with a lot of choices to be made, and now is the time to start thinking about this, Ciciora said, noting that compression is a by-product of high definition television (HDTV). Ciciora also stated that compression will not replace NTSC signals; will not eliminate upgrades; and that high speed digital transmission may not be compatible with some systems.

The applications for compression are most likely to be new revenue streams, specifically expanded pay-per-view (PPV) and near video on demand. After expanding on the possible ways to implement the two, Ciciora spoke of the major factors in creating scenarios for using compression, mainly: bandwidth of the system; compression yield; number of NTSC channels needed; and the number of HDTV channels desired.

Numerous unsolved issues

The options to be sorted out are many, stated Ciciora. Should the hardware be in-home or out-of-home? Some proposed approaches have single channel per carrier, others have time division multiplexing. Intra-frame coding limits motion artifacts but maximum compression is not acheived. Symmetry of processing is another consideration. One of the easiest choices to understand, says Ciciora, could be the most difficult to make: when should compression be implemented?

Ciciora also touched on VCRs and compression, along with the consumer electronics interface, before summarizing by saying that video compression will be available soon; it is now good and will get better; and it will have an important part in the future of cable. He concluded by stating that the biggest problem is the amount of choices, but that now is the time to think about it.

Paul Heimbach, senior vice president of engineering for Viacom Networks Group, spoke on "Suggested Technical Specifications for Cable/Satellite Video Compression Systems." Because compression is such a major technological issue for the '90s, Heimbach sees the need for a number of pitfalls to avoid as the industry moves forward: "compression systems could be containing and not liberating if performance issues are not addressed." These issues include signal quality, compression ratios, signal coding and modulation techniques and compatibility with auxilliary signals.

Heimbach first defined compression, saying it is data reduction applied to a video signal. Because the reconstructed picture is not as good as the original, compression must conceal the fact that pieces are missing. Heimbach said there is limited satellite capacity which erects a barrier to new programming, but compression will allow programmers to find more capacity.

Minimum specs needed

The development of a compression system should meet industrywide criteria. Some of these are: the operational environment; the number and quality of compressed channels; the compression ratio change tracking; image quality; error propagation; adjacent satellite/same satellite interference; vertical blanking interval/ closed captioning; and encryption/ addressing.

In regard to image quality, says Heimbach, the development of test parameters and signals must be done along with the development of a compression system. "We must develop a definition of quality," says Heimbach. He finished by stating "compression is an exciting technology, but the techniques are being developed—input is needed to ensure industry needs are met."

Bill Woodward, staff engineer for Scientific-Atlanta Inc., addressed his paper on "An Overview of the JPEG and MPEG Video Compression Specifications." With digital video compression becoming a fast growing technology, several compression standards are emerging: JPEG (Joint Photographic Experts Group) which specifies the compression and decompression of single frame images; and MPEG (Motion Picture Experts Group) which specifies the compression and decompression of motion video. Woodward focused on the standards and how they actually work.

Woodward gave two reasons for compression: to increase the number of video signals and the possibility of improving quality because digital and channel impairments are less. Data compression encompasses two classes: lossless and lossy. Lossless schemes rely on "reducing the redundant information in the data while representing the data with as few logical indicators (bits) as possible." Lossy schemes "throw out information and rely on human psycho-visual properties in order to keep the distortions produced by data compression from being perceived."

Lossless compression techniques (used in both JPEG and MPEG) are run length coding, variable word length coding and predictive coding. Woodward then explained each technique before explaining in-depth the JPEG and MPEG specifications. In concluding, Woodward stated that it is unlikely that any significant technical changes will be made before the specifications are approved. All specifications will provide a basis for video systems of the future.

Compression benefits all

The final paper focused on "A Digital Video Compression System for Satellite Video Delivery," by Michael K. Stauffer, director of new business development for Compression Labs Inc. Stauffer discussed a complete digital video/audio compression system for transmitting multiple NTSC video signals over a single satellite transponder. The system was developed by Compression Labs.

Stauffer first stated the benefits of the system, including: multiple channels; digital transmission robustness; small antennas; and digital circuitry equating to lower equipment costs. The design objectives are to: provide eight to 18 video channels per transponder; better than VCR video/ audio quality; small receiver antennas (less than three foot in diameter); and affordable prices for consumer premise equipment.

The key technologies of the system include video compression (discrete cosine transform (DCT), variable length coding, conditional replenishment, motion compensation); audio compression (Dolby adaptive delta modulation); digital transmission (RF QPSK met objectives, was robust and bandwidth efficient); and conditional access. ■

—Kathy Berlin

Coastel Tools displayed its cutter head for automatic stripping of coaxial cable. Under powered drive, the tool uses centrifugal force to cut a cable. The metal used for the cutter blade has an expectant life of 15,000 strips, say company spokesmen. The cutter head can be used by either attaching to an in-house drill or by using Coastel's rechargeable NiCad powered driver. The cutter head is ordered by specifying a connector size. Using the cutter head "would be far more consistent, even when the blades start dulling," says David Bahrenburg, president of Bridgepoint Communications Inc.

Lindsay Specialty Products introduced a new line of 1000 MHz passives. Features of the series include 15 amp power passing; 20 dB return loss; motherboard design for non-disruption of service; non-corrosive hinged zinc housing with chromate finish; and improved surge protection. Although Lindsay attempted to "push current products," it couldn't be done and "this is a totally new technology" says Brian Ward, key accounts manager.

Midwest CATV announced an exclusive distribution agreement with **Northeast Filter Company**. In the agreement, Midwest will supply Northeast's patented and warranted traps. Northeast's traps offer a unique patent that extends the upper frequency limit into the superband (over 300 MHz). According to Chris Sophinos, president, the announcement is timely as the cable industry nears its involvement with the upcoming Olympic games.

Midwest also announced its purchase of the patents, molds and proprietary rights to recently acquired Drop Shop's Super Splitter line. The Super Splitter offers flat "F" ports on both horizontal and vertical splitters, dual grounding lugs, 600 MHz bandwidth, 125 dB of RF shielding and anti-corrosion plating. The move to purchase the line and its associated patents and molds is to "continue to supply the industry with Super Splitters at established Drop Shop pricing," says president Chris Sophinos.

A new company, **Remote Coat Enterprises**, offered up the "Remote Coat" protective device for handheld remote controls. Comprised of a stretchable sleeve of synthetic foam, Remote Coat was designed to protect a remote control unit without interfering with its operation. It can be left on as a permanent fixture, to be taken off only for battery replacement. Remote Coat also features a clear plastic shield

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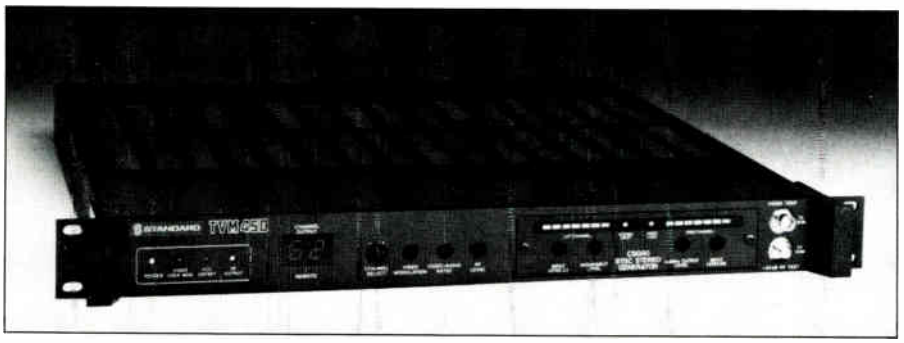
Reader Service Number 22



Standard's TVM-450 frequency agile modulator

that covers the control panel and protects the unit's function switches and buttons from dust build-up and liquid spills. Remote Coat Enterprises will design and produce a Remote Coat to fit any operator's remote control units.

Standard Communications Corp.'s SatCom Division has a new version of its frequency agile modulator. The model TVM450S integrates Standard's CSG-60 BTSC generator into the modulator chassis creating an MTS stereo, CATV modulator compatible with all RF scrambling formats. Because of the "surprising interest in the industry at stereo," says Clayton Dore, Standard saw "a need for a low cost, high performance stereo unit."

The front panel video modulation, audio deviation and visual/aural carrier ratio controls have precalibrated center indentations. A user leaves the controls in the center indents and adjusts the VideoCipher or receiver to the correct output levels required for optimum BTSC performance.

TVC Inc. displayed a prototype of a new locking terminator in which the end of the tool locks in a star design around the edge. The terminator will be available beginning in late April. Also introduced by TVC, and available now, is a 125 dB RFI FM splitter.

Telecommunication Products Corporation (TPC) announced compatibility of its Queue Master software with the following routing switch manufacturers: Dynair, Grass Valley, 3M, Pesa, Tel-Test, Utah, Scientific and Videotek. Unveiled at last year's NCTA, Queue Master is a timed event controller that controls routing switches, videotape recorders and other equipment on a real-time basis.

Video Data Systems announced its beginnings as a new company providing laser disc-based barker systems, commercial insertion and standalone playback systems. Introduced by the fledging company was the Laser Ad Insertion System (LAIS), the Laser Cine Machine (LCM) and the Laser Auto Promo System (LAPS). The three systems are designed around a programmable, real time computer that activates one or more Pioneer Laservision playback units.

Viewsonics introduced a new compact power inverter, which operates on 12 volts DC input. The inverter is designed to run equipment needing up to 1 KW of power at 115 VAC, 60 Hz—such as test equipment, hand tools, lights, televisions or household appliances. The inverter includes a duplex output for easy plug-in, a carrying handle, automatic turn-on and turn-off from standby and overload protection. U.S. and European versions available.

Westec announced a new low phase solid state source, used in AML type systems. It is on the market as a replacement component for improved performance. Also displayed was a pre-production model of an outdoor AML type receiver, 550 MHz wide, which has a self-contained power supply. ■

—Roger Brown, Kathy Berlin and Leslie Ellis

If a system embraces interdiction, how will that affect compressed signals? Can operators afford to essentially invest twice for conditional access devices?

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Reader Service Number 23

Tackling the in-home wiring conundrum

Cable television system operators should work together to educate consumers, home builders and contractors of the hazards associated with do-it-yourself coaxial wiring, said Larry Nelson, chief operating officer of Comm/Scope Inc. and chairman of the NCTA Engineering Committee's in-home wiring subcommittee. Nelson made his comments during a technical session titled "At the end of the line—cable, connectors and consumers" at Cable '91 in New Orleans.

As cable operators continue the practice of charging monthly fees for additional outlets, many subscribers have taken to splitting the incoming signal and wiring additional outlets on their own. The practice often leads to low picture quality, use of substandard products and increased risk of signal leakage.

The problem is exacerbated by the lack of minimum standards to insure safety, compatibility among various products and quality.

Nelson recommended that the process begin by applying local operator standards by taking a proactive role in educating contractors, electrical suppliers, video retailers and consumers on the needs of the system vis a vis the indoor materials used. This approach allows local policy control, immediate standards decision making and a starting point for long-term consumer education.

The torture chamber

Following Nelson's presentation, Brian Bauer of Raychem Corp. relayed the results of a CableLabs funded project that was devised to examine the effects of corrosion on F-connectors in "tough" environments. Bauer explained that the drop has long been considered CATV's weak link (the vast majority of service calls are related to the drop system) and this project was undertaken to better understand corrosion's dynamics.

After explaining the test procedures, Bauer concluded with the following suggestions:

- Use braid materials which are both generally less corrosive and more compatible with contacting surfaces.
- Use moisture sealing methods to repel electrolytes and slow the corrosion process.
- Mechanically stabilize the cable surrounding the interface to limit "fretting" corrosion.

Thomas Martin, a Jerrold engineer, then presented the case for an RF "bypass" converter as a way to maintain addressable security while at the same time enhancing compatibility with consumer electronics.

Admittedly, the device is not meant for universal deployment (it works optimally in homes taking basic and one pay service and desiring PPV access), but it could offer operators another way to gradually introduce scrambling security with broadband delivery of signals.

The device tunes and descrambles one pay channel then insert that channel into the "bypassed" combination of basic channels. Tuning of the pay channel is controlled by a downloaded command from the headend, and is then remodulated to the output channel frequency. In the meantime, the bypassed channels are notch filtered to remove a channel (to provide space for the pay channel).

This process keeps the subscriber out of the channel selection function. In fact, the converter could be located behind the TV or at the cable entrance to the home. Subscribers continue to use TV and VCR remotes, as in off-premise systems.

Finally, Jerrold's Tom O'Brien presented an overview of the physical and media specifications of the coaxial bus (CXBus) portion of the Electronic Industries Association's (EIA) consumer electronics bus (CEBus) communications protocol.

The issue of home automation has been percolating for several years and is poised to make some real progress as the National Homebuilders Assn. prepares to make its SmartHouse product a reality later this year. A similar, but different program undertaken by EIA standardizes the communications between automated home appliances.

Video communication inside the house is supported by the CXBus, which was described by O'Brien. His presentation related to information about the media and tap insallation, connection of appliances, range of signal levels, bandwidth allocation, information coding and media bridging. He noted that CATV technicians will need to know how the system works as the time approaches to troubleshoot such systems.

—Roger Brown

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Reader Service Number 24

Engineers get candid about PCN

Personal communications networks (PCN) are the hottest buzzwords in the industry today. But is the concept a hot reality? Engineers participating in a PCN technical session at last month's NCTA were a bit more skeptical than in recent weeks. "I'm not saying it's impossible, but I think it may be a bigger challenge than we all think," remarked Tom Gillett of Media Management Services. "I'm a bit skeptical of the recent, glowing market predictions."

The session, moderated by Cencom VP Larry Lehman, took a hard look at the business, marketing and engineering challenges surrounding PCN—and the mood was decidedly precautionary. Wilt Hildenbrand, VP of engineering support for Cablevision Systems Corp., summed it by saying, "I can't help but think there are other revenue opportunities out there with less regulatory baggage than PCN."

Bill Killen, VP of planning and analysis for Cox Enterprises, also waved a yellow flag. "When the news of Cox's application for an experimental FCC license to test PCN hit the streets, the press kept calling me for my comments on 'putting the telcos out of business,'" Killen laughed. "I kept reinforcing: This is a test. This is only a test."

Interestingly, the panel included two cable operators currently in the throes of experimental PCN testing—Hildebrand and Killen. The third, Tom Gillett, led off by discussing the factors surrounding the potential business.

Market potential a reality

Based on a study performed by marketing research company A.D. Little, 63 percent of the American public would embrace PCN under two conditions: if the phone itself were kept at $100 or less, and if the incremental monthly phone charges did not exceed $10. "I'm doubtful about our ability to profitably provide PCN services at the $100/$10 price break," says Gillett.

But, Gillett continued, the revenue potential is enticing, even from a conservative approach. "Assume a 25 percent penetration of PCN in 10 years, where CATV infrastructures provide the service. That translates to a $1 billion a month potential," Gillett continued. To get there, though, a multi-billion dollar investment in PCN is necessary. And, "few, if any, companies have the resources needed to independently finance, plan and execute a PCN plan," Gillett said. To that end, he feels important strategic alliances are needed with either or both cellular and long distance providers. "Cable's greatest value is in its capacity as a transportation alternative," Gillett explained.

(Interestingly, a Comcast representative in the audience rose after the session to discuss Gillett's proposed strategic alliances. Comcast, a cable television and cellular service provider, is currently using both arms of the company to scratch its back. "We intend to show the industry what and where the [strategic alliance] deal is," the Comcast employee said.)

'Assume a 25 percent penetration of PCN in 10 years, where CATV infrastructures provide the service. That translates to a $1 billion a month potential.'

Gillett continued his presentation with an outline of the technical complications surrounding the envisioned digital, wireless voice service known as PCN. These issues include the development and maintenance of a database, switching network, base stations, and interconnects—not to mention a frequency battle. "All of these things, as well as regulatory concerns, can only be summed up as 'yet to be determined.' What's needed is further market analysis, strategic alliances, and about a two- to three-year learning curve. After that, we can then decide whether the technical glamour is out of sync with market realities," Gillett said.

Up next was Hildenbrand, who explained why Cablevision applied for the experimental license. "I felt it was very important to examine the impact of this technology," Hildenbrand expressed. "We're not unique. We're intrigued with the concept of two-way and status monitoring and the possibility of knowing when a subscriber has unplugged an F-fitting—the whole bit."

According to Hildenbrand, the company seeks to apply a two-way digital system that could be overlaid into PCN as a means to "narrow the list" of questions regarding enhanced POTS (plain old telephone service), full mobility, cell locations and customer specification services. As a first step, Cablevision Systems is conducting propagation tests to determine "what the ring (around the cell) looks like and the size of the cell," Hildenbrand continued.

Hildenbrand broke the PCN concept into three key elements:

- Handset to antenna/base station
- Antenna/base station to switch center
- Switch center to public switched telephone network.

Wrapping up the session was Killen, who called his company a "PCN pioneer" because Cox was the first cable company to apply and receive an FCC experimental license. Cox is in the midst of a 24-month test in its San Diego, Calif. and New York systems.

The Cox network is based on current fiber rebuild/upgrade plans, with a design that "inserts fiber to every ninth amplifier," Killen explained. "We're testing four frequency ranges: 902 MHz to 928 MHz, 1850 MHz to 1990 MHz, 2400 MHz to 2483 MHz and 5725 to 5850 MHz. But I think the 1850 MHz to 1990 MHz has the most viable potential—it's simply a bandwidth-rich environment.

"The key for us right now is cell size," Killen continued. "The size varies widely—that's why we need to test. To determine the optimal cell size." Killen did offer the following cell size estimations based on fiber depth within the cable system:

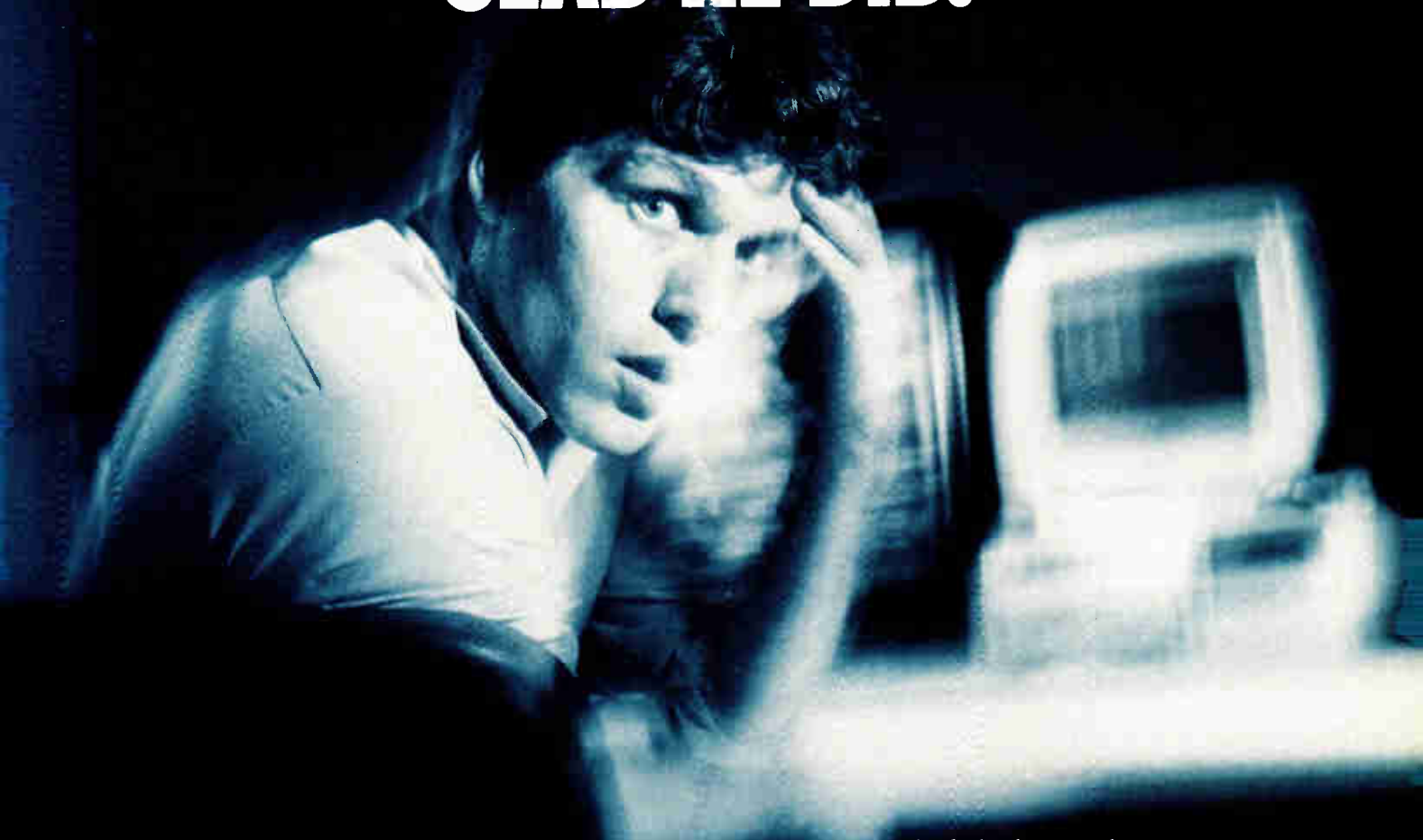
- Fiber to every ninth amplifier: cell size of 1.5 miles
- Fiber to the serving area: cell size of 0.5 miles, serving 1,500 homes
- Fiber to the feeder: cell size of 1,600 feet, serving 100 to 200 homes
- Fiber to the curb: cell size of 100 feet, serving four homes.

Regardless, though, coax is a key, Killen emphasized. Because "if traffic demands smaller cells and if fiber isn't deep enough (into the cable system), we'll need a hybrid fiber/coax system in order to reach the cell.

"Our goal is to take this network and prove that it can work. That's our obligation to the FCC," Killen concluded. ■

—Leslie Ellis

JERRY BIRNS ELECTROCUTED HIMSELF TODAY. AND HIS BOSS IS GLAD HE DID.



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Reader Service Number 25

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PCNs: A new opportunity for cable

Personal Communications Networks (PCNs) is quickly becoming one ofthe hottest topics in the industry as cable operators begin to examine how they can capture a portion of the multibillion dollar voice and data communications market.

There are many issues that must be sorted out before PCN becomes a business in an already crowded market. Traditional Public Switched Telephone Network (PSTN), cellular telephone, Integrated Services Digital Network (ISDN), private bypass services and new radio-based carriers (such as Fleet Call) all compete with PCN to provide communications. In addition, there are technical issues that must be resolved and interface standards decisions that must be made before PCN is ready for deployment.

By Geoffrey S. Roman, Vice President, Strategic Marketing, Jerrold Comm.

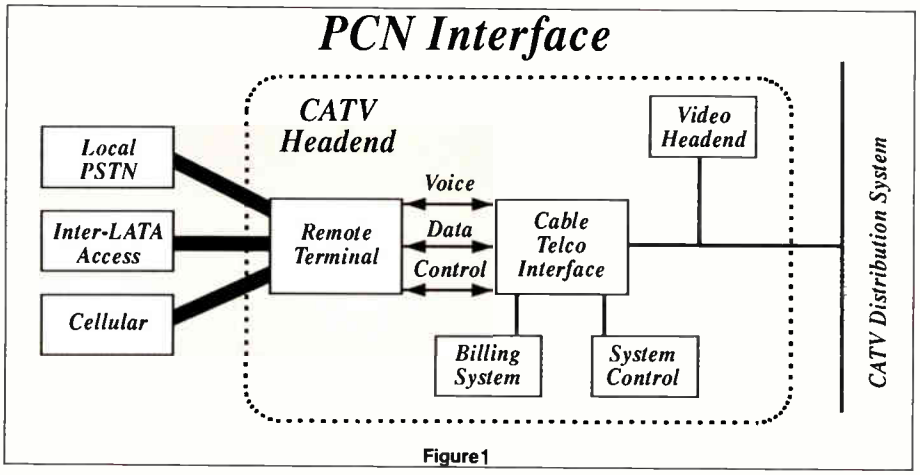

Figure1

What it can do

Before assessing the technological alternatives, it is important to understand what we are tying to configure PCN to do. In its simplest form, PCN is an expanded range cordless phone which allows its user to make and receive phone calls not only while within a small radius of the home, but also while at a neighbor's home or while shopping.

On the other hand, it can be a low cost supplement to cellular phone which allows users to make calls at a lower cost—when they aren't moving at vehicular speeds.

PCN can also serve as a wireless PABX for businesses with large numbers of employees who move throughout the facilities such as universities, hospitals and other campus environments. The technology can also provide communications within buildings, eliminating the need for expensive wiring to telephone instrument locations within office areas. Or, PCN can serve as an enhanced paging system, eliminating the need to locate a pay phone to return a call in response to a page.

PCN can serve as a bypass of the wired local telephone system to access long distance carriers offering cost

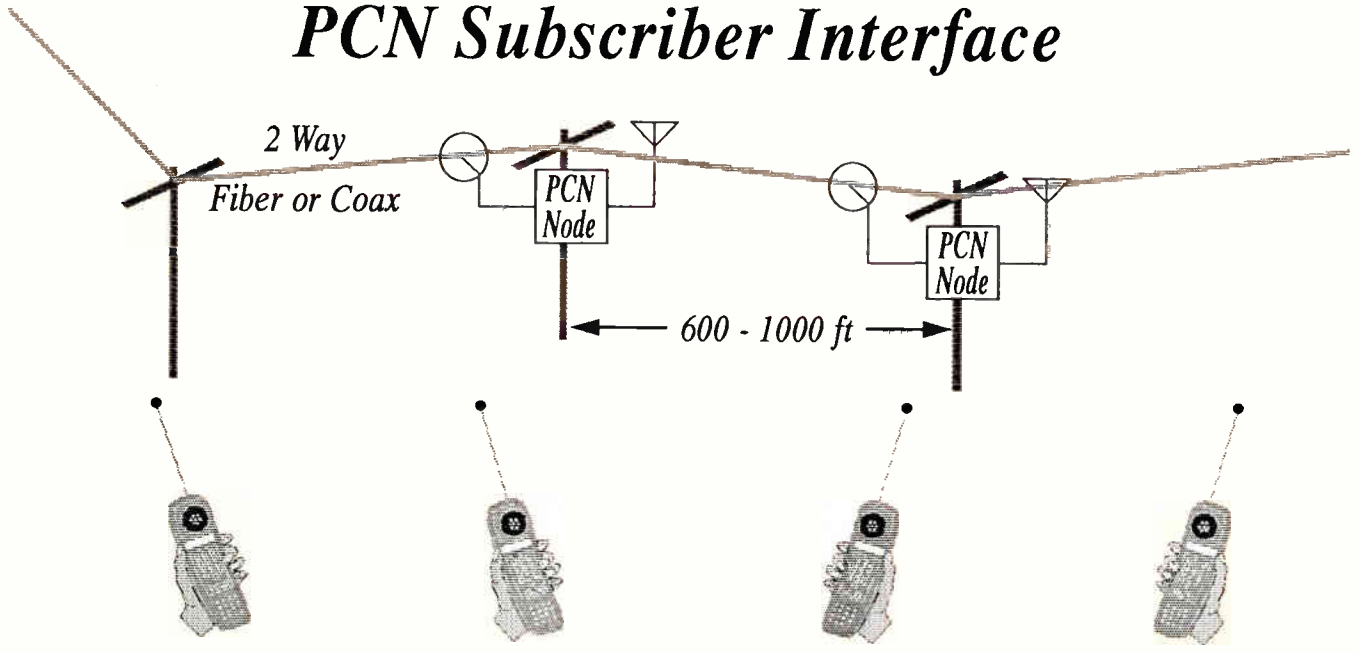

Figure 2

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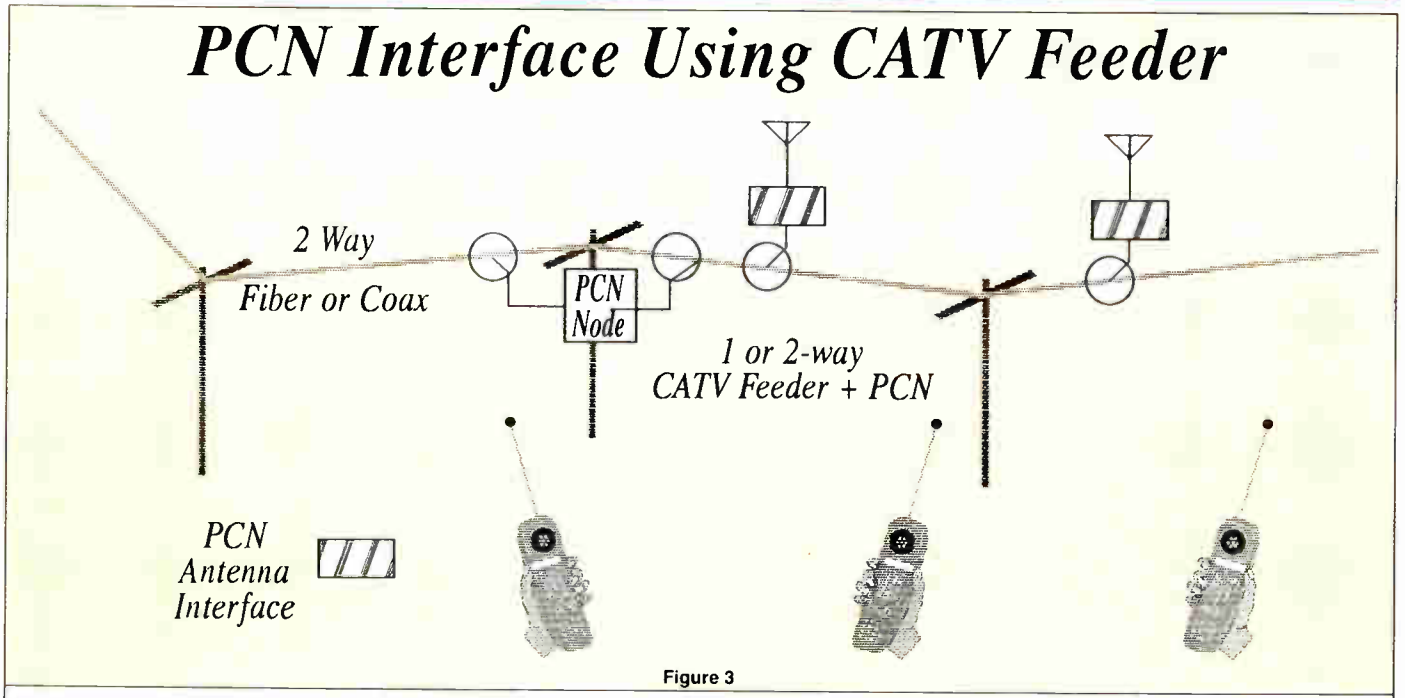

Figure 3

savings to both users and the long distance carriers.

Additionally, PCN can be a vehicle to provide transaction, monitoring, and control services—many of the services the cable industry has discussed for the last 15 years, but have not been implemented because of the difficulty in establishing and maintaining a return path in large coaxial cable systems. At last, though, cable television may become the vehicle for in-home integration.

What it can't do

However, there are some applications PCN doesn't efficiently satisfy. PCN is not a replacement for the cellular telephone in mobile applications. The fundamental PCN architecture is based upon low power, frequency reuse and small cells. At a 60 mile per hour speed, six to 10 handoffs (transfer of calls between basestations) would be required each minute. This handoff process requires extensive monitoring and control capabilities in the network and is a significant factor in the cost of cellular systems.

PCN is also not likely to become a replacement for wired telephone in large businesses with large numbers of users who tend to be stationary or have calls handled by co-workers when away from their desks. Similarly, PCN is not well suited for high-speed data transmission.

Similarly, PCN transmission techniques are not readily compatible

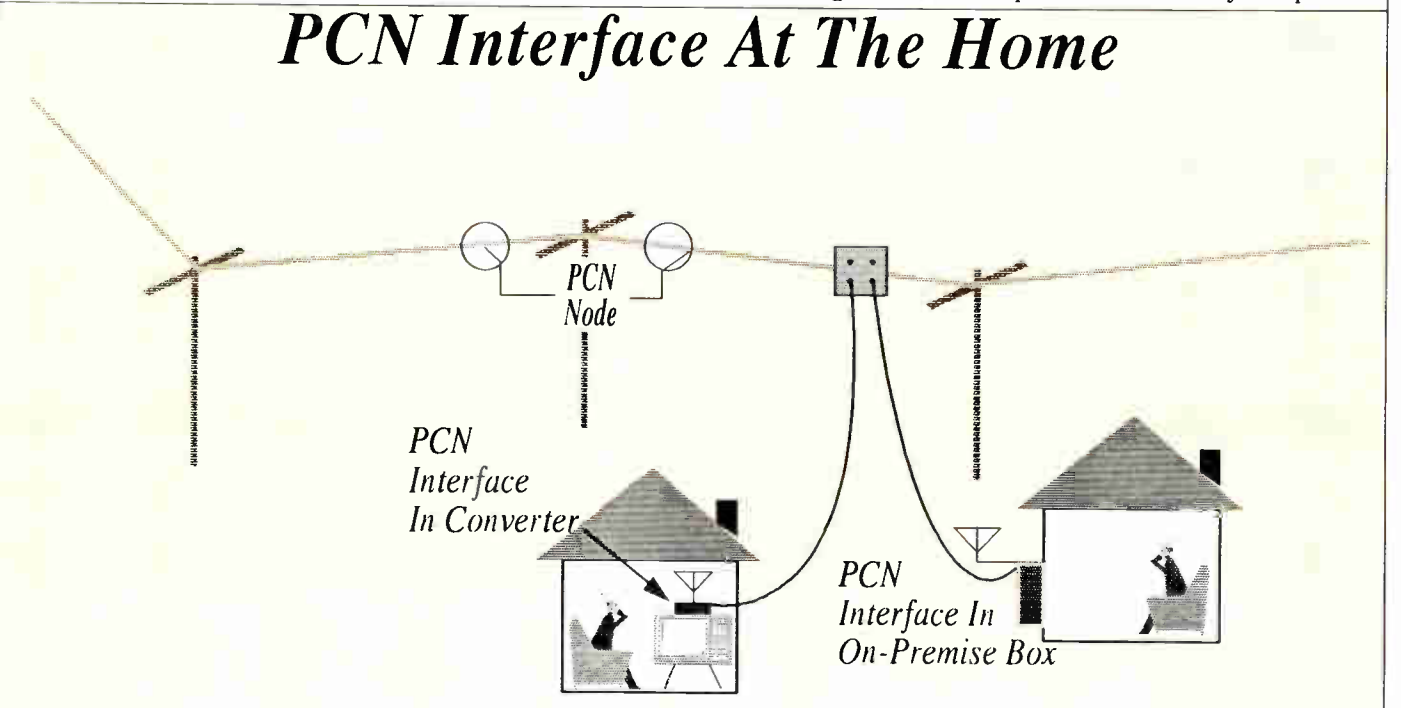

Figure 4

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with 9600 baud fax transmission—but could be used for lower speed requirements for users with low duty cycles. And finally, PCN is not likely to replace the wired phone as the only phone in the home, not because of technical performance but for logistic reasons. To summarize, PCN is the pedestrian cellular network.

To provide PCN services, certain elements are required. Since PCN radio basestations will be distributed throughout the service area every 700 to 1,500 feet, extensive right of way is necessary to interconnect each basestation with central switching and interfaces to other carriers. An added requirement is that this right of way contain two-way transmission capacity.

In addition, a customer service organization and an organization to support the maintenance of distributed elements is required. Technical control capability of the network and a billing system infrastructure is also needed. Finally, the ability to power distributed nodes is necessary.

But the good news is that cable television operators are well positioned to support these requirements, for many reasons. The widespread deployment of fiber optic technology is rapidly making two-way plant a reality. The continued upgrading of customer service standards is positioning the industry to take on a broader role. Addressable control and pay-per-view billing systems are the beginning of the technical areas of this infrastructure.

Competition looms

However, cable television is not alone in pursuing PCN. The telephone companies also have most of the attributes PCN requires, but lag behind the cable industry in the amount of bandwidth in the distribution portion of the system. In most areas, the distribution system for the telcos still consists largely of twisted wire pair plant. Cellular operators also have the ability to use some of their frequency spectrum to provide a transportation infrastructure and should not be counted out as participants in PCN. Power companies also possess most of the attributes required, but do not have communications plant in their right of way.

Table 1 lists the most common frequencies being considered for PCN transmission over the air. In general, the higher the frequency, the shorter the propagation distance of the signal will be. Reflections and penetration of solid objects like buildings become increasingly significant issues as frequency increases as well. Many of us have seen satellite television pictures degrade significantly or even disappear as a hand is passed in front of the antenna feedhorn. This illustrates the kind of propagation issues that face the architects of the PCN transmission system. These problems with extremely high frequency transmission can be offset by increasing power or using more robust modulation techniques.

The 900 MHz frequency range is very attractive for PCN use since the band is available for use under Part 15 of the FCC regulations. This means that service could be instituted without extensive regulatory process for frequency allocation. The band is also attractive because much of the needed RF hardware is already in or nearing mass production, yielding low costs from the outset.

Spectrum wars on horizon

However, the same lack of a requirement to obtain a frequency allocation that speeds PCN entry may present one of the most significant obstacles to use of the 900 MHz band. This frequency range is already used by wireless local area networks, paging systems, wireless VCR transmitters, vehicle location systems and a host of other services. Further, other services are likely to be developed over time which will further complicate transmission in this frequency range.

Of the remaining bands, the 1.8 GHz band is the most attractive. While propagation is more difficult than at 900 MHz, it is considerably more predictable than at the higher frequencies. Use of this frequency range can also share some of the equipment developments for the United Kingdom's PCN implementation, DCS-1800, which operates in a band ranging from 1710 MHz to 1880 MHz. Moving higher in frequency, the propagation issues become increasingly complex to accommodate reasonable distances between the handset and the network antenna in situations other than an unobstructed line of sight between them. Also, the cost of the RF electronics in the handheld transceiver and basestation also tend to increase with frequency due to design and manufacturing tolerances.

Still running

The most significant issue in power

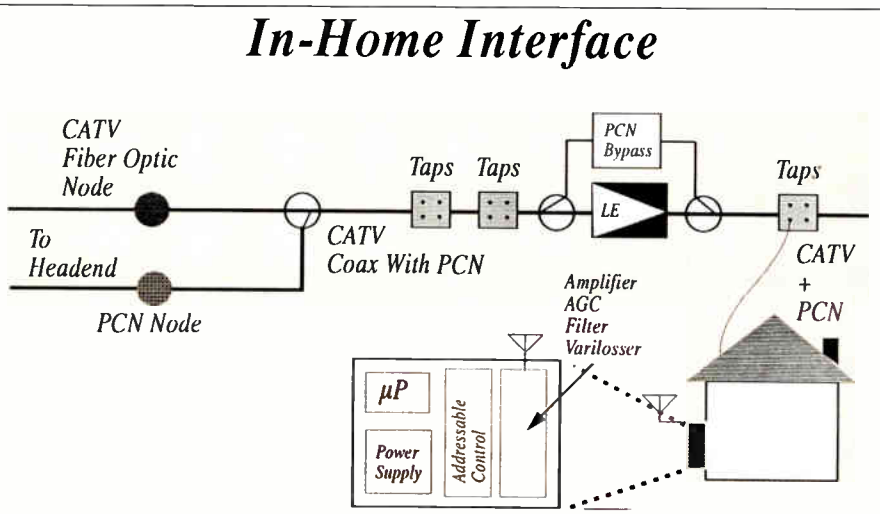

Figure 5

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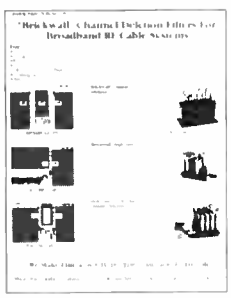

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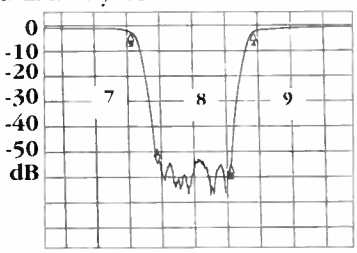
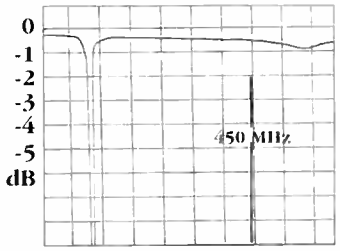
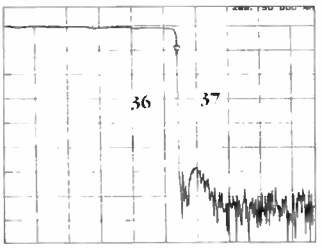


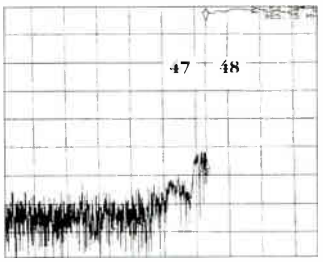
Single Channel 50 dB Notch, Leaves Adjacents In Service 3271ABH-8



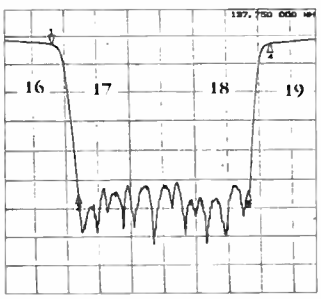
Low Off Notch Attenuation To At Least 450 MHz Type3271ABH-8



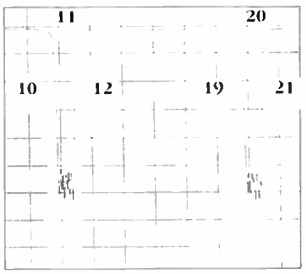
Brickwall LPF 6211LP-36/37 Passes Channel 36 Down, 50 dB Channel 37 Up



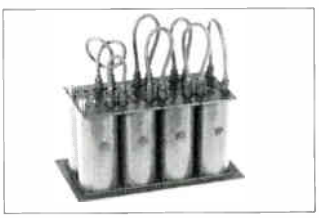
Brickwall HPF 6211HP-47/48 Passes Channel 80 Up, 50 dB Channel 47 Down



Contiguous Multichannel Type 7964-17/18

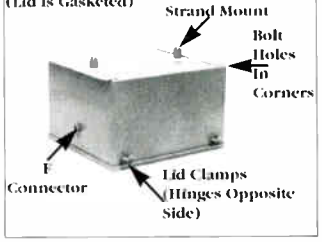


Scattered, Multichannel Type 6971-(2)(11,20)(450)



Single Channel Hyperband 3271ABY-FF

Weatherized Box (Example)



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determination is battery life. Those who own portable cellular phones have typically experienced battery life of 45 to 90 minutes usage or ten to 20 hours of standby time. The portable cellular phone has 0.6 watts of output power and uses a rechargeable battery which retails for about $50. These portable cellular phones have a useful range of up to a few miles and operate in a band in the 800 MHz frequency range.

Cordless telephones using CT-2 technology in the United Kingdom operate with 0.01 watts of power, also in the 800 MHz frequency range. These instruments have a useful range of 1,000 feet or less, but have battery life sufficient to support hours of conversation and several days of standby operation with a low cost rechargeable battery.

If PCN is to reach the masses, it must have a battery that has sufficient life to accommodate use by the general public—who are typically less attentive to proper recharging than are most cellular users. And, mass acceptance of PCN depends upon a small transceiver package which dictates a small battery size. This will tend to push in the direction of lower power output which will in turn limit range.

Another issue affecting power output is network capacity. Cellular telephone, a hybrid network with 0.6 to 3.0 watts output, has a maximum capacity of about 200,000 phones in an area. PCN is envisioned as a ubiquitous network which serves ten times as many subscribers. If PCN is to accomplish this in a manageable (and available) amount of frequency spectrum, the system must encompass a significant amount of frequency reuse. This also yields small cell size and complements battery life in driving the network to relatively lower power.

The cellular network uses predominantly analog FDMA (frequency division multiple access) transmission between the portable phones and the basestations. It is moving to TDMA (time division multiple access) digital transmission in those areas where traffic is beginning to overwhelm the analog system—New York and Los Angeles, for now. CDMA (code division multiple access) was considered, but rejected for these locations. Both approaches allow for greater efficiency of channel usage at the cost of complexity and, depending upon the hardware implementation, power consumption. CDMA transmission is also very robust in its ability to be transmitted in an environment with severe interference.

In fact, the technology was developed initially for military use under conditions of enemy jamming signals. Such transmission techniques may allow use of the 900 MHz Part 15 band for PCN despite the other users in the band. By spreading signal components over a larger bandwidth, the likelihood of successful reception is increased.

In general, at least initially, CDMA transmission is likely to be more costly than TDMA or FDMA transmission. Determination of the spread spectrum bandwidth required for successful transmission is the subject of many investigations by the experimental licensees.

Figure 1 shows the evolution of the CATV headend to accommodate the PCN infrastructure. In addition to the traditional video headend components and the addressable controller, PCN requires a network interface to deliver

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the telephone signal to the distribution network. This interface includes the required RF modulation and demodulation equipment and may incorporate the lasers and optical detectors to couple to fiber optic plant on dedicated fibers.

Alternatively, the telephone signals may be carried on the same optical fibers used for CATV transmission and share transmitters and receivers already in place. This interface also contains the switching intelligence to both complete calls within the PCN system and to direct calls to the proper external carrier. These external carriers provide the inter-LATA access (AT&T, MCI, Sprint, etc.) local calling (PSTN) and cellular access to mobile telephones. The PCN operator also needs a billing system capability or, at a minimum, the ability to capture the required transaction information to furnish to a third party billing system.

Advantage, CATV: Wideband

A possible PCN subscriber interface is shown in Figure 2. PCN basestations are located every 600 to 1,000 feet and are connected to the headend via the fiber optic and coaxial cable distribution plant. Each of the basestations has the necessary intelligence to assign channels to users' transceivers and perform required handshaking. Each basestation contains an antenna, transmitter and receiver; the basestation also couples the signals into the cable system.

A deployment of PCN in this manner is based upon the limits of the traditional telephone distribution system architecture. Cable television systems have a significant advantage over this architecture: a wideband (potentially 1 GHz) transmission path all the way to the home.

Capitalizing upon the large bandwidth available throughout the CATV distribution plant, the scenario shown in Figure 3 uses distributed

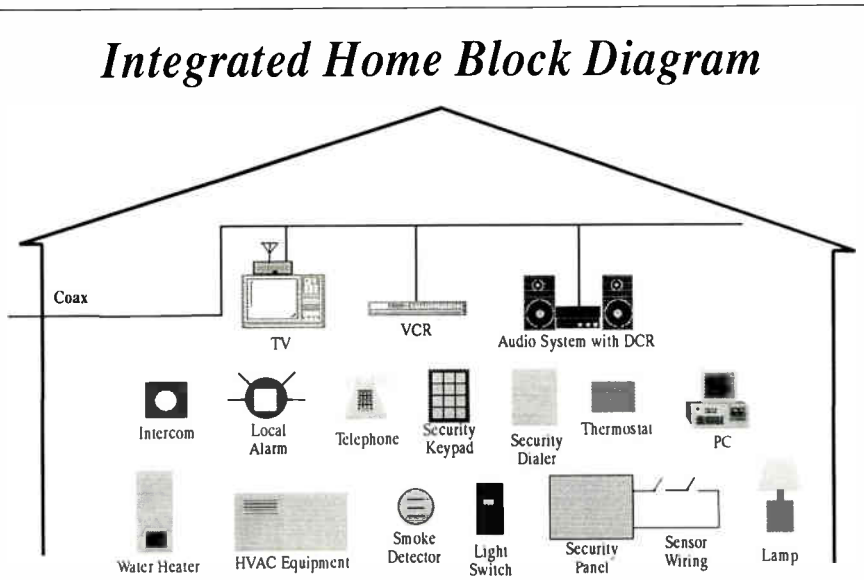

Figure 6

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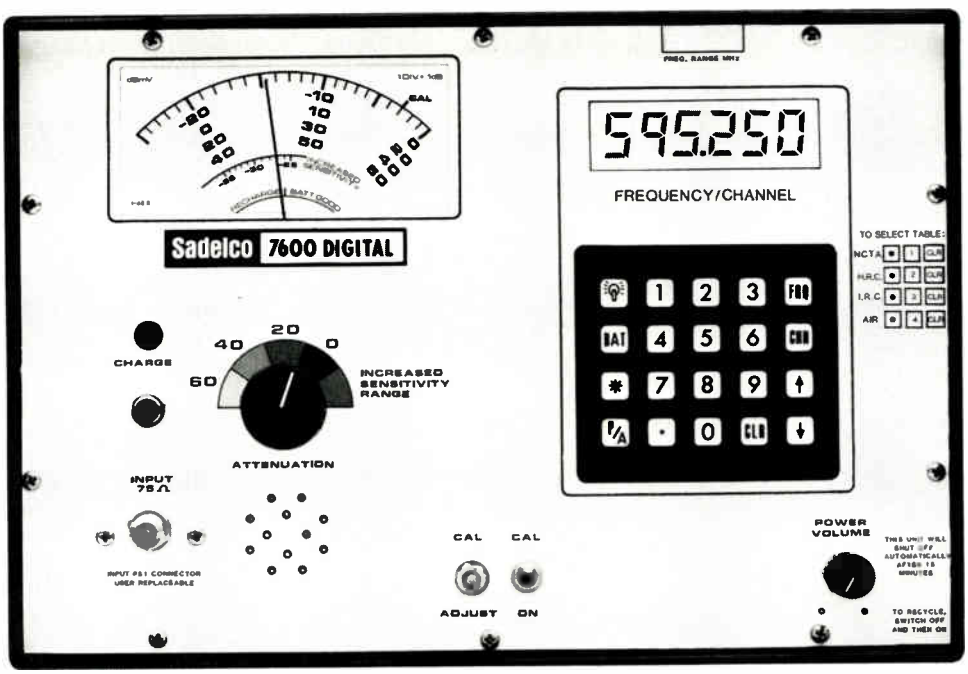

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antenna interfaces located where the PCN basestations are located in Figure 2. These antennas are then connected to the PCN basestation using the CATV feeder plant. Either the traditional sub-split, two-way plant or enhanced one-way plant can be used to provide the links to the antenna interfaces. One-way plant is enhanced to provide two-way communication by using the frequency spectrum above the forward passband of the system for the PCN links.

Any CATV actives in the path are bypassed using external diplex filters separating the CATV and PCN frequencies. These bypasses can be active or passive depending upon the path loss from the basestation to the associated antenna interface locations. Systems passive and any multitaps in the path must pass these higher frequencies as well. The goal of using distributed antenna interfaces is to reduce the cost of system implementation by sharing the intelligence of a single PCN basestation among a number of antenna interfaces.

The antenna interfaces contain filtering, level matching, and frequency conversion circuitry, if necessary, and are located every 600 to 1,000 feet as dictated by the propagation characteristics of the system chosen. If the PCN frequencies are chosen to reside in the 900 MHz band, these frequencies could be directly carried on the CATV feeder plant resulting in a simple and low cost antenna interface. Higher frequencies would necessitate frequency conversion at each antenna node.

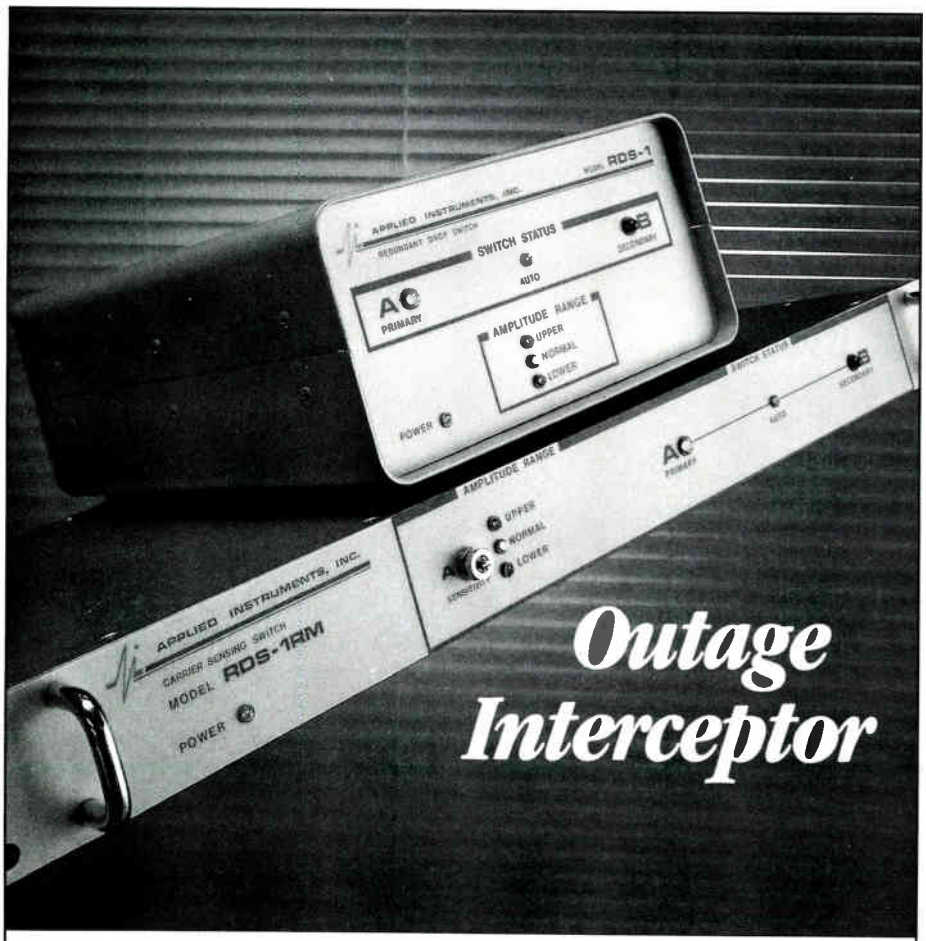
Cell sizes

The fact that in most cases the cell size will be dictated by the propagation distance rather than traffic capacity allows system implementation using this strategy. Proponents of both TDMA and CDMA approaches are claiming an average of around 40 simultaneous conversations can be handled in the band of frequencies supported by a basestation. Using traditional blocking statistics, this basestation could support 240 to 400 subscribers, considerably more than are likely to be located within the propagation distance of the basestation especially early in the PCN deployment cycle.

This tactic can be used early in the PCN rollout to provide service throughout the franchise area using a moderately large number of antenna interfaces linked to a single basestation. Then, as traffic grows, additional basestations can be added consistent with the growth of the revenue stream. Because of the deployment of fiber optic technology, cable operators have considerable flexibility in basestation location.

Co-location with fiber optic nodes makes sense in terms of a physical location to serve associated antenna interfaces. However, the large transmission capacity of the optical fiber transmission systems makes it possible to centralize much of the system intelligence in the headend. By sharing this hardware addition, cost savings can be realized.

Distribution of the antenna interfaces along the feeder line is acceptable in areas with aerial plant and creates major problems in areas with underground or buried plant. To resolve this problem, the antenna interface could be moved to the home itself, as shown in Figure 4. The antenna



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interface could then be incorporated into the set top converter or an on-premise box located at the service entry to the home. The broadband drop into the home is a unique advantage of the cable TV architecture and the broadband link between the PCN basestation and the antenna interface in the home allows any PCN user in range to communicate via the in-home interface. The in-home antenna interfaces would be supplemented by external devices for those ares of the franchise area where there are not sufficient cable subscribers to provide full coverage, particularly commercial and industrial areas. The in-home interface detailed in Figure 5 allows further cost synergies by sharing some resources between CATV and PCN.

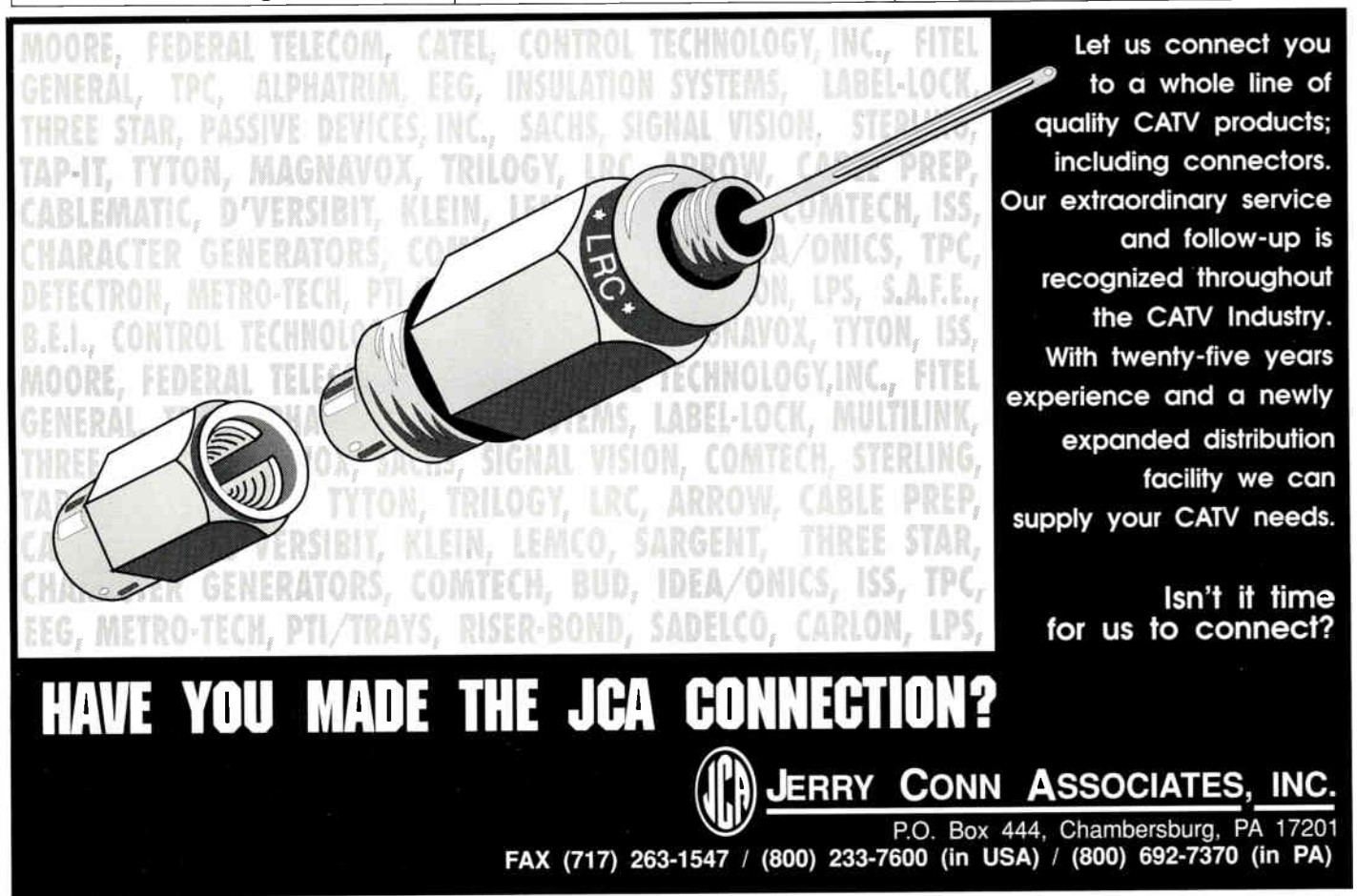
Blue sky services reachable

Because PCN offers a reliable two-way path into the home independent of wiring within the home, it may make possible all the "blue sky" services that have been talked about since the early 1970s. Energy control and security monitoring are two services that were deployed by a few operators but were not widely implemented in part because the cost of the wiring the home and maintaining the RF return path. PCN can also be a vehicle for further deployment of pay-per-view using both ANI and store-and-forward technology and potentially, even make the vision of interactive TV a reality. Additionally, PCN may be the vehicle to bring about the integrated home as shown in Figure 6.

Standards are a key in making PCN a reality. For operation other than in the 900 MHz band under Part 15, the FCC's allocation process will be a major milestone is launching the PCN business. The growth of PCN will heavily depend on a ubiquitous service. Because a dozen or more cable operators serve the area around virtually any city, agreement on standards is particularly important for the cable industry. These standards need to address frequency, modulation type, power and cell spacing—plus issues like ringing standards, handoffs and billing.

Ringing is problematic as subscribers roam beyond their local service area (as every cellular user has at one point discovered). It has been proposed that PCN be integrated with a paging system as a means of locating users who have roamed out of their local areas. The degree to which subscribers can move while in conversation needs to be resolved. The handoffs between basestations area among the attributes of cellular telephone that contribute heavily to system cost. Limiting the handoff capability can help reduce the cost of the PCN architecture. The distributed antenna interface, itself, may offer sufficient coverage to avoid the need for additional handoff infrastructure. The average cellular bill costs over $3 per month to prepare, because of the portability of cellular phones which necessitate gathering data from a variety of sources. To address these issues, alternatives such as debit cards and smart cards are being considered.

PCN offers the potential of significant revenue to the cable operator. Likewise, cable has a significant competitive advantage for providing the transmission infrastructure to the distributed antenna interfaces throughout the service area. In-home integration offers further revenue opportunities. There are a number of standards-related issues which must be resolved before PCN can become a business. These are subjects of investigation by the experimental licensees. ■



Fiber architecture perfecting platforms

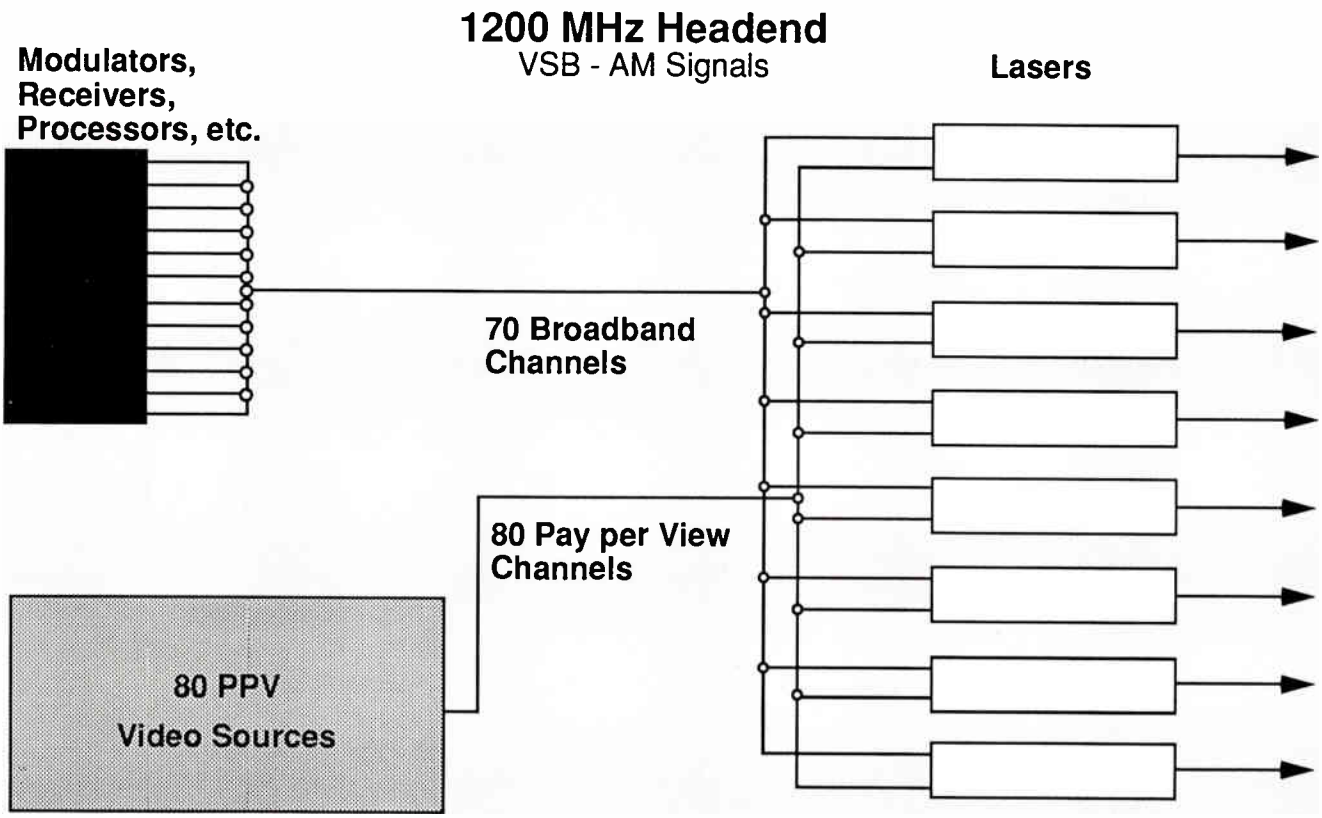


Figure 1

The cable television industry is alive with debate about and planning for the expanded bandwidth and new approaches to signal transmission all coming on the heels of increased deployment of fiber optics.

The increased capacity of these networks and technological progress at the component level will mean not only capacity for more analog channels, improved performance, potential reduction of signal leakage, and all the well known advantages of optical fiber plant. But with digital transmission techniques allowing for signal compression, not to mention optical amplification, external modulation or coherent transmission schemes, further expansion of channel capacity will be possible over the same fiber links being installed today.

By George Sell, Contributing Editor

These technological breakthroughs, in turn, promise to open the door to innovative programming opportunities, exciting new services and businesses, and plumb the platform for high definition television. Debate continues over fiber network architectures and the components in the network. The intensity of the debate is a clear sign of the health of the industry.

What is at issue is making the right technological decisions today that will pave the way for maximizing the opportunities seen on the horizon. While the discussion within the technical community has typically focused on fiber architectures, it is the application that determines the architecture.

As the old saying goes, "If you don't know where you are going, any path will take you there." Different applications determine different architectures. And it follows that if you build one way you may not be able, in the future, to do what you want.

A goal expressed by some cable strategists is to reach optical nodes that feed a few hundred households with hundreds of channels, many new video services and even telephony in the form of personal communications networks (PCN). "We technologists are being told by marketers that the ultimate goal should be a single node that feeds 200 to 500 customers," says Dr. Aleksander Futro, director of technology assessment for CableLabs Inc.

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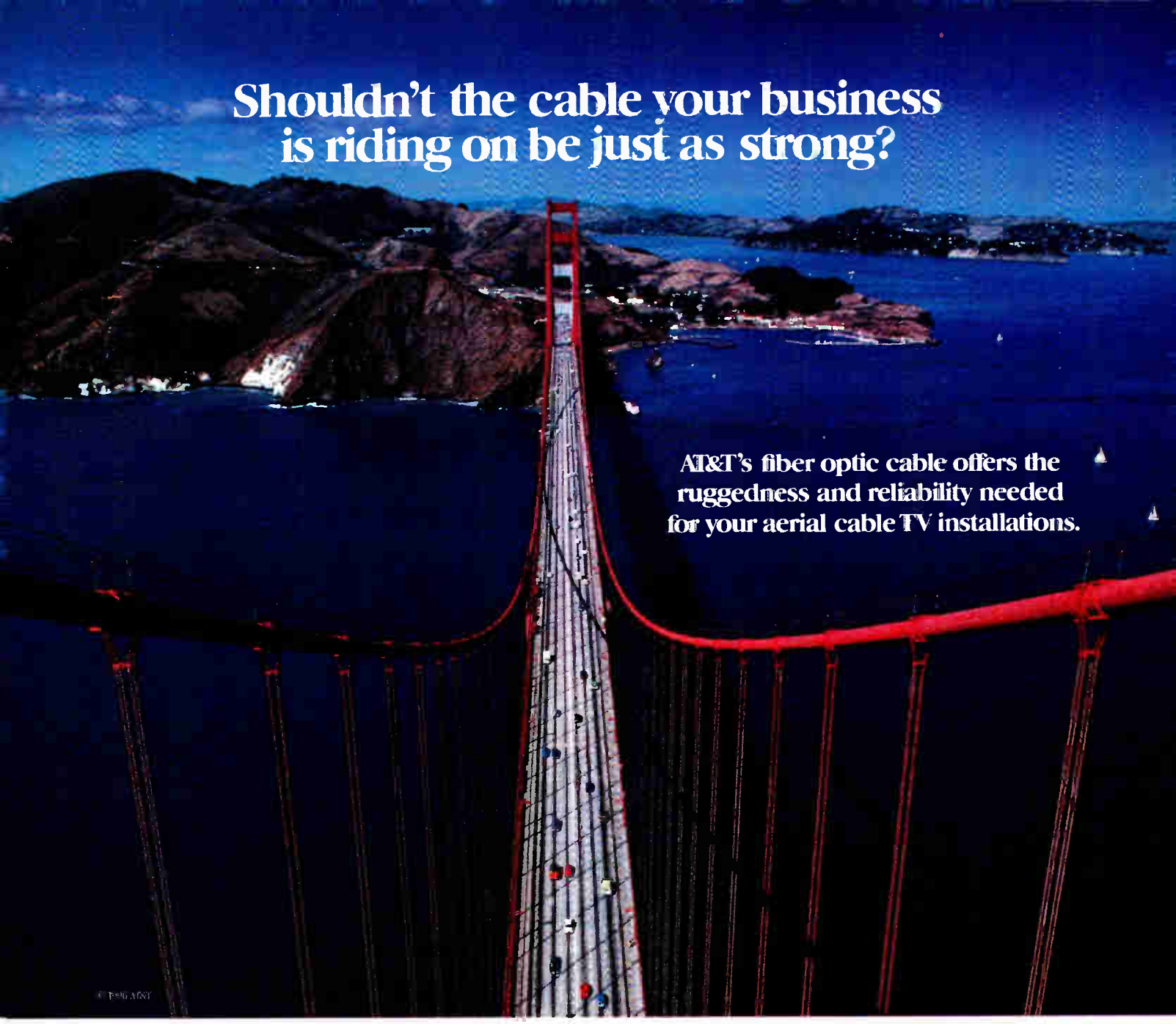

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near-video-on-demand, because we are targeting such a small audience," Futro continues. "With the help of statistics, without having a switched network and so on, we can give nearly everybody who is on the system whatever they wish, whenever they wish."

Pertinent to this architectural issue is how signals will be distributed. The question is: Will all signals be distributed to all termination points in a "broadcast" mode throughout the network? Or will a different set of signals and services, in a segment of the spectrum, perhaps the 600 MHz to 1200 MHz range, be distributed to different neighborhood nodes, employing dedicated fiber links, in a "narrowcast" mode along with all signals in the lower 50 MHz to 550 MHz range distributed commonly to all these nodes in the network simultaneously?

Distribution: Broadcast vs. narrowcast

These two schools of thought have emerged relative to signal distribution, each with its own set of application flexibility requirements inherent in the architectural configuration: Optical broadcast and optical narrowcast. Optical broadcast is ideal for applications where a set of services is commonly sent to every drop in the system. With a full 1 GHz analog line-up, this means a single 150 channel menu of programming to every subscriber on the system.

Optical narrowcast, on the other hand, is ideal for applications such as Time Warner's Brooklyn-Queens, New York project where the 150 channel capacity will, at some near-term point, likely be utilized to provide separate and distinct menus of programming to different neighborhoods.

For example, a block of Spanish language programs can be narrowcast to one area while using the same spectrum slice to send Korean language programs to another. "What we intend to do in Queens, for example," Jim Chiddix, senior vice president for engineering and technology at American Television and Communications (ATC), says, "is to initially use that high spectrum for more analog NTSC channels.

"But that leaves open the option of later getting even more channel capacity by adopting [digital] compression." Although some would argue that 150 channels will be plenty (so were 12 channels and 30 channels, once upon a time), Time Warner's narrowcast distribution application, and the architecture to do it, adds the kind of flexibility that will be critical for cable systems to achieve multi-channel near-video-on-demand and a plethora of other revenue producing services.

Distributing signals in a broadcast mode, whether in fiber tree-and-branch or a star configuration, would require very high output power lasers, an extremely low loss budget, and splitting in the field to feed many optical nodes in the system.

The single return path in this design, with digital traffic for transactional services and near-video-on-demand, would be faced with contention problems assuming those businesses succeed as market strategists predict. In addition, there's the potentially heavy loading on such a network architecture that PCN will impose.

And how would operators obtain high output power, a low loss budget, and splitting in the field? There are significant risks in opting for fiber optic technologies that today still exhibit high costs, risks and theoretical unknowns such as 1550nm lasers, optical amplification and dispersion-shifted fiber.

"And if you go to 1550 nm without optical amplifiers, still the components and lasers are not equivalent in quality as 1310 nm," Futro points out. "So as a result, we have talked about optical amplifiers the last 12 months, that they are around the corner, and we had some announced nearly a year ago. And still if you go and try to buy one you can't."

Deployment of optical amplifiers in the field could be problematic. "There is one major statement that must be made on optical amplifiers as they are hoping for them for deployment. These units will [initially] need to be placed in the headend environment. These will not be units that you can deploy in the field. It will take us awhile before we can get quality units that can be reliably deployed in the field. And that statement can be validated by all manufacturers who work on optical amplifiers.

"But still we are making this quiet assumption in our minds that once we have them we can place them wherever we wish, on the pole, underground or whatever. It is not true," Futro stresses. "The first optical amplifiers will be located in the headend only."

As has been echoed elsewhere by technical planners, Futro suggests, "Neither 1310 nm nor 1550 nm will

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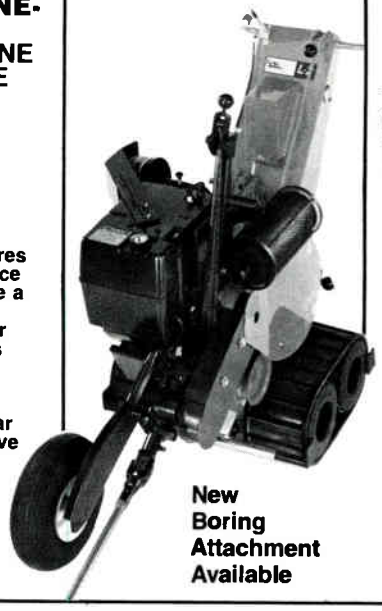

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dominate the future cable system. And as a result, we recommend deployment of 1310 nm zero-dispersion fiber, in other words the same fiber which cable operators have been deploying for so many years.'

Platform evolution

"I've talked about evolutionary stages and one follows the other," says Chiddix. "[First] You realize the bandwidth your network is capable of and then you further enhance the capacity of that network by adding compressed [digital] signals, although we think it makes sense to keep a line-up of analog signals in the lower part of the spectrum in order to be able to deliver signals directly to TV sets.

"But initially I think we view that as something that you do in a 'broadcast' way. You have these compressed digital channels that go everywhere [see Figure 1]." Chiddix believes there are businesses which justify that today, namely multi-channel pay-per-view. "But once you've realized the potential of that kind of capacity, then you can go beyond even that by adding switching and a different mix of compressed channels to each neighborhood. And at that point you essentially have infinite channel capacity. You may be sending several hundred channels to each neighborhood but with the switching it's a different several hundred. And if the neighborhoods are small enough you can serve individual subscribers with individual channels," Chiddix projects.

If, ultimately, the network is evolving toward switched services and the ability to deliver different things to different neighborhoods, it will not involve sending all signals everywhere in a "broadcast" mode, according to Chiddix.

"We are going to want different forward and return paths to different neighborhoods just for PCN to interconnect microcells," Chiddix adds. Callahan explains further: "Let's assume that we have a node size that serves 200 homes because of an architecture that people want to move toward for future services. In that case, then you can dedicate these compressed digital channels just to those 200 homes. Now, the laser feeding a dedicated fiber to that receiver has two packages of services on it. The lower half, say below 550 MHz are the 70 analog channels that are the same transmitted throughout the network. Above 550 MHz and going out to 1200 MHz providing 600 MHz bandwidth, let's envision 80 channels of compressed digital signals that are unique to that collection of 200 homes. "So the laser has two different loads on it," Callahan says.

"It has a lower group of 70 analog channels and an upper group of 80 digital channels. That's why now you need a separate laser per optical node feeding just 200 homes. Therefore having the advantage of high power and an erbium-doped amplifier really goes away because you need a separate laser for every little neighborhood of 200 homes. You can't take the same laser and split it 16 ways and feed 16 nodes because the only way that would work would be to have everybody with the same package of channels," Callahan stresses.

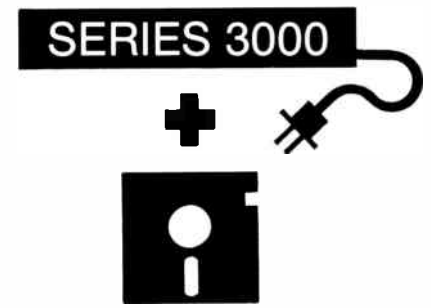
Dedicated laser links

In this architecture signals are being distributed in a narrowcast mode. The entire 50 MHz to 1200 MHz spectrum is transmitted through one laser transmitter, one fiber and to one optical node feeding 200 homes. Below 550 MHz it is analog and the same signals reach all subscribers no matter which node is feeding them.

And above 600 MHz it is all compressed digital, with different services going to each node. But the entire cable system is made up of dedicated laser/fiber links at the same wavelength of 1310nm.

"Speaking philosophically, and there are things to be worked out in detail on a system by system basis," Chiddix offers, "an approach that I think makes some sense is to go ahead and implement a 1 GHz plant and an FTF architecture using homerun fibers from the headend out to each neighborhood (see Figure 2). And I would argue that today four fibers per [residential] neighborhood is plenty.

"I'm not sure that it makes sense to save money on fiber by doing splits in the field," Chiddix suggests. "Fiber is relatively cheap and there's not a huge premium on bringing all the fibers back to the headend and doing your splits at the headend. What that means is you have then preserved the separate path to each neighborhood to and from the headend. And your return signals all come back directly to the headend and your outgoing signals all go out directly to each neighborhood. "We [at ATC] are envisioning building all of Queens [New York] with these



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homerun fiber runs using 1310nm laser transmitters.

"We view 1550 nm as sort of a hole card," Chiddix continues. "It adds into our systems that we are not going to use initially." In the dedicated homerun fiber link approach, according to Chiddix, "Signals are applied to one laser per fiber trunk (see Figure 2). Initially, a fiber trunk will undoubtedly contain more than one fiber in the outgoing direction. High frequency signals will be applied to one of the lasers feeding each fiber trunk, and the fiber on that route will transport that particular slice of spectrum out to the node, which will then be combined and put on the coax."

A high output power 1550 nm fiber tree-and-branch network distributing in a broadcast mode would be unnecessary and may eventually be a limiting factor for this hybrid analog/compressed digital application. "The only reason you would do it that way is if the economics really dictated it. But putting in a [fiber] tree-and-branch structure, then that gets in the way of the next step which is adding the switching, where you need a separate route to each neighborhood," Chiddix concludes.

"Some are of the relatively small school that say we want to focus on 1550nm fiber amplifiers because everybody gets the same package of services," says Callahan of Antec. "Therefore, if you can get a laser and fiber amplifier combination with high power that will allow you to feed eight or 16 receive sites, it's much more economical—well, it is if you are only looking at today's applications," Callahan adds.

"Optical amplification is a technology which forces specific architectures," explains Futro. "And no matter if an optical amplifier is used at the headend where you increase output power and then you split it into so many fibers which are going to small nodes, or you have infinite signal distribution so you have splitters in the field where you have some signal, amplify it, split it, you amplify it again. Something like that supports architectures where you are in a 'broadcasting' mode."

According to Callahan, "This is in sharp contrast to the 'narrowcast' mode in which low to medium power lasers distribute different programming to each node in the system." No splitting and no high power lasers would be needed. "It's really broadcasting verses narrowcasting, and high power verses low power," Callahan continues. "With broadcasting, where everybody gets the same services, you want the highest powered laser or fiber amplification, or whatever combination of technology you can find to lower the overall cost of the transmitter per optical link.

"But with narrowcasting and trying to get a separate package of services to each cluster of several hundred homes throughout a franchised area, you don't use a high powered laser and split it many times," Callahan reiterates. "You use lower powered lasers which are available today and work very nicely at 1310 nm, and you dedicate a laser and a fiber to each little neighborhood of 200 to 300 homes."

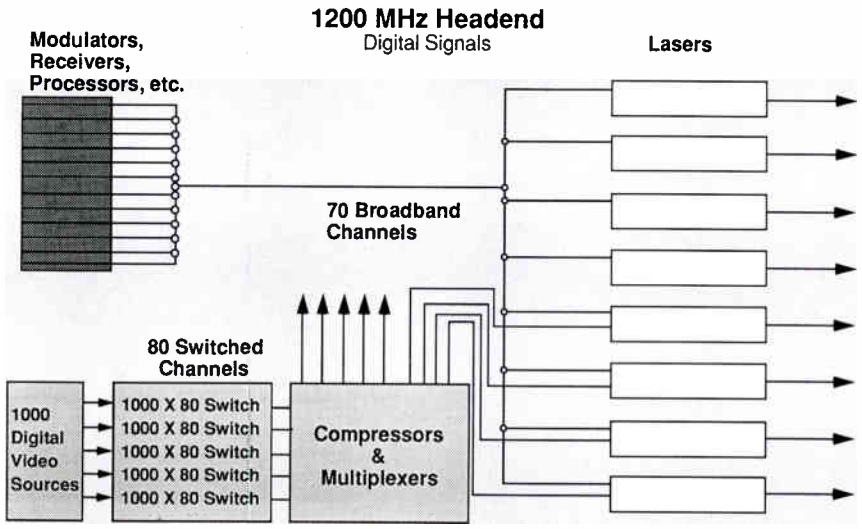

FIGURE 2, Narrowcast Loading

Figure 2

Future fiber capacity

Will we need to lay in extra "dark" fiber in the network for use at some future time? "Not very much," says Chiddix. "I think the technology is going to continually increase the capacity of the systems we put in today just by letting us carry more and more on each fiber.

"Whereas today we may take three fibers to carry 1 GHz, in five years we may be able to carry 1 GHz on one fiber and have two extra fibers right there. What's more, if we need more capacity in the future we be able to get it from WDM (wave division multiplexing), or adding 1550 nm, or coherent modulation," Chiddix projects.

"On the other hand, there are opportunities for dark fiber like business interconnection and so forth. So each system has to figure out the balance there by analyzing their market. But it's just good to keep in mind that the technology is going to get us more bandwidth capability out of existing fiber paths as time passes.

"At this point we view fiber as more or less a commodity. We think the fiber we are buying today is going to have a long, long life and be capable of doing a lot more years from now than it does today and a lot more ten years from then," says Chiddix. "It's hard to go too far wrong putting in fiber today."

How fiber is today configured in an architecture is critical for what distribution application we will need. And, in turn, the distribution modality will be determined by the services we distribute. If all the same signals are to be delivered to all points in a fiber network, the so-called "broadcast" mode, then we may have to split extensively in the field which means waiting for optical amplification, external modulation or some other future high power optical technology.

But today's 1310 nm lasers and standard fiber with a dispersion null at the 1310 nm wavelength, in an architecture where dedicated optical fiber links are homerun to small neighborhoods, the so-called "narrowcast" mode, will yeild ongoing benefits over time. It will provide the platform for all services envisioned today. And, as may become necessary well into the future, even more capacity can be gained on such flexible platforms by network design and through further progress at the component level. ■

"When the going gets tough..."

Reader Service Number 36

signals to optical form

- Concentrates personal communications network traffic
- Serves as a radio transmitter site
- Provides SONET (Synchronous Optical Network) multiplexing and cross-connect functions for wireline traffic.

As indicated in Figure 2, the OTN houses AM receivers, AM transmitters for return path data and video signals and a personal communications network concentrator and receiver. The OTN is also seen as providing required cross-connect and multiplexing functions required to process digital traffic. It's important to note that although the current industry practice is to put AM receivers in a strand-mounted housing—a logical move to support today's core business—the industry will at some point also need to consider a cabinet as it weighs the merits of additional new businesses.

With this ring...

At the same time, the blueprint provides seamless integration of services for business customers, using a ring topology popularized by alternate access (metropolitan area networks) carriers to provide high-bandwidth voice and data transport to businesses, science/research and educational institutions. The infrastructure envisions the mating of an optical ring featuring optical route diversity, which provides commercial customers various configurations of network multiplexing capabilities.

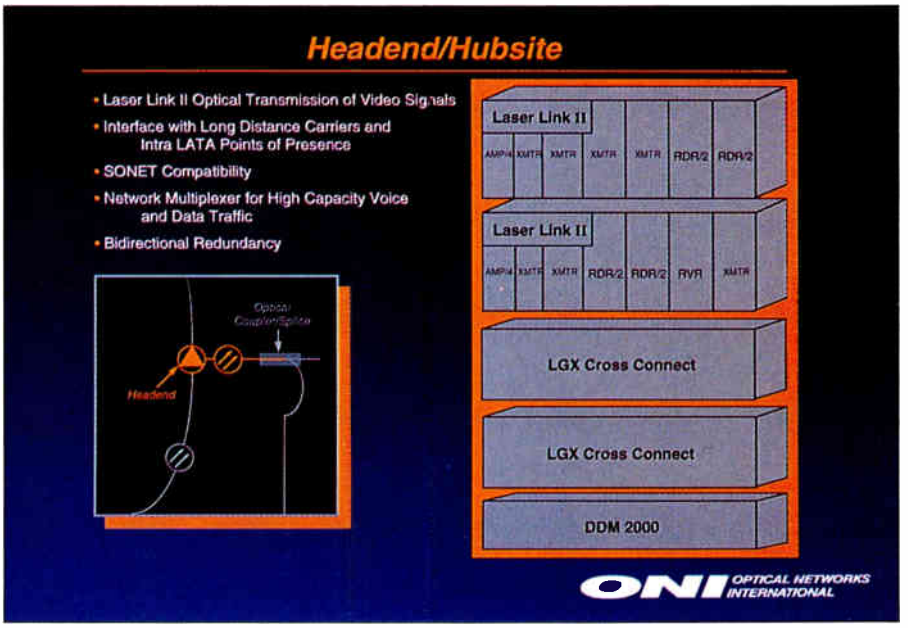

Figure 3

As part of the suggested design (see Figure 3), the headend becomes a sort of signal routing facility, containing cross-connect and multiplexing equipment required to hand long-distance traffic off to interexchange and local exchange carrier points-of-presence.

The model's key feature is the blending, in a single architecture, of network topologies suited to the differing needs of residential and business customers. Equally important is the adaptation of modern principles of network design in place of the traditional telephone industry local loop architecture, which featured feeder plant consisting of large cable bundles containing 1,200 to 3,600 pairs of wire typically branching out from a central office along four or five major routes using "bridged taps" to feed smaller distribution cables that terminated at customer homes.

In the late 1970s, though, telephone networks began to incorporate the "serving area" concept, in which a local exchange area was divided into quadrants, or serving areas. The idea was to minimize initial capital investment by allowing gradual installation of distribution cables as home density grew, instead of installing all distribution cable at once. The interface between the feeder and distribution plant was the "serving area interface," a network transition point that in some respects parallels the OTN and originally served as a manual cross-connect point, matching any single feeder wire pair to any distribution line. Using the serving area design, feeder plant was limited to 10,000 feet while distribution lines were about 2,000 feet.

With the advent of digital signalling, especially digital loop carrier (DLC) technology which multiplexes 24 individual voice channels into a single 1.544 Mbps data stream, the feeder plant terminated at a remote terminal capable of multiplexing and demultiplexing the signal streams and feeding individual subscriber lines. Although there is no technical reason that DLC technology must be based on optical fiber rather than copper media,

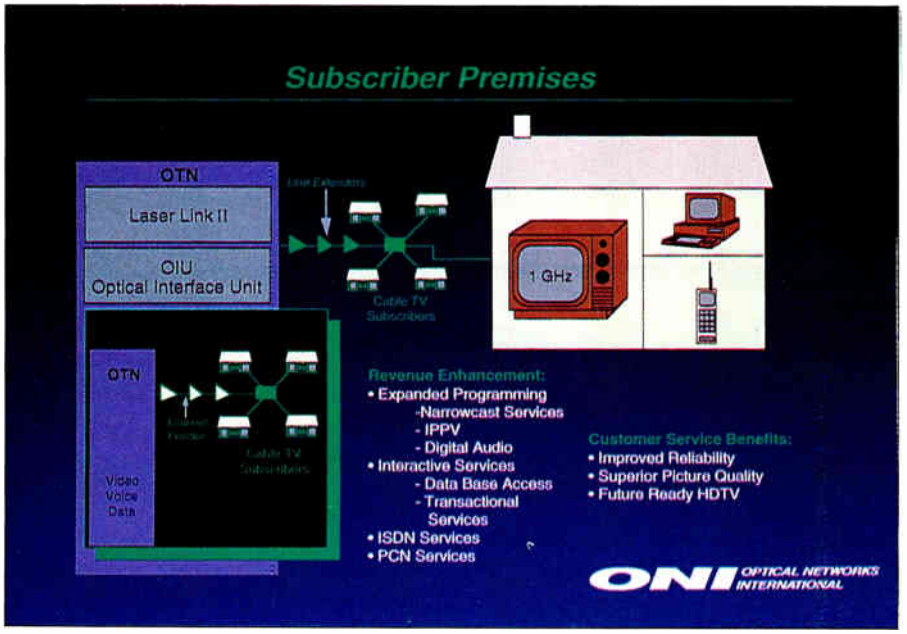

Figure 4

"When the going gets tough..."

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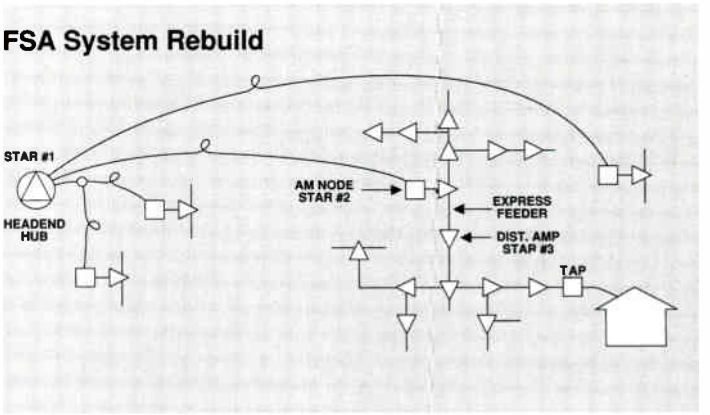

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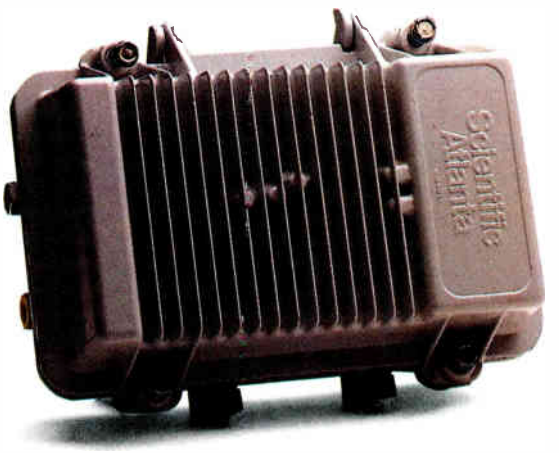

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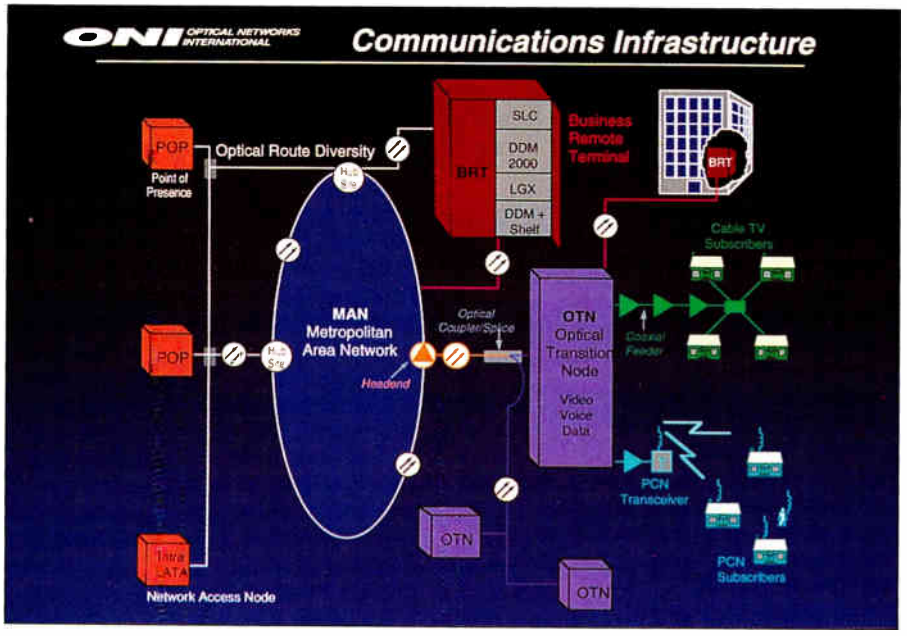

Figure 1

The cable industry stands on the threshold of the most momentous changes in its technological base since vacuum tubes replaced transistors and satellite-delivered programming was introduced. And just as those important innovations set the stage for industry growth, so too will the next wave of technical change make possible the embrace of new businesses and revenue streams.

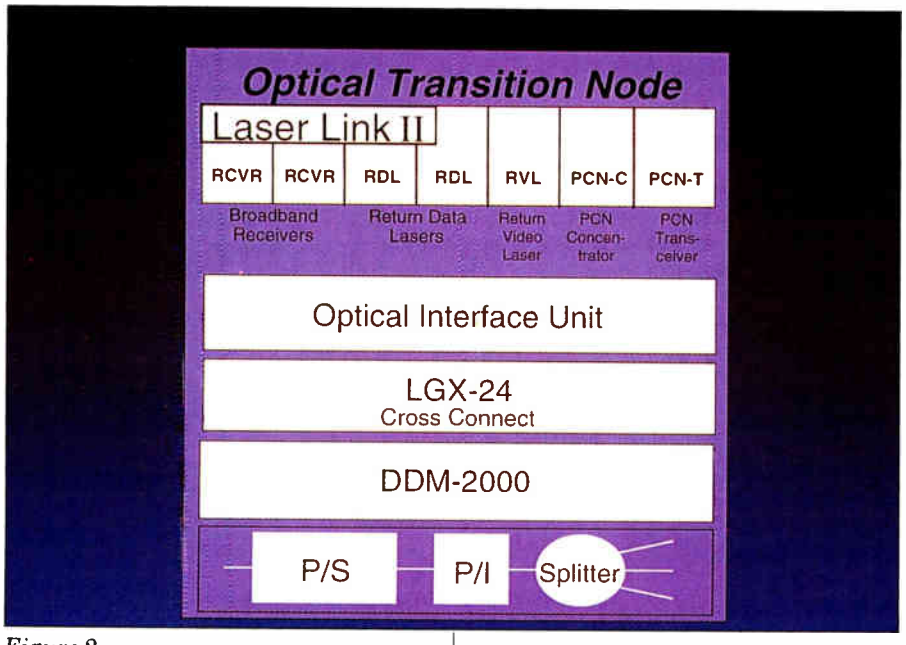

Figure 2

By Andy Paff, President, Optical Networks International

It might be easy to say fiber optic technology represents cable's third great technological wave, but that would only be part of the story. Equally important are key innovations in system design and use of digital transmission equipment originally developed for telephone applications.

These applications enable the evolution of single-purpose entertainment networks into multi-purpose communications facilities that can provide not just video, but data and voice services to residential and business customers.

Preparing for the future

Indeed, by deploying cost-effective optical fiber platforms that extend the optical path ever closer to customer homes, cable operators can prepare for important future business opportunities that extend far beyond video entertainment.

One such architecture, triggered by operator demands, offers a graceful solution to future necessities. It can be thought of as a general purpose model, not a specific architecture. As such, it may be considered an "open architecture" that incorporates key insights developed by numerous operators.

The ONI communications infrastructure (see Figure 1) is a dynamic model for the industry's evolution to digital signal delivery, transmission of voice and data traffic.

An integrated services network

The blueprint, developed in conjunction with AT&T, describes an integrated services network that interfaces with digital transmission systems and provides a foundation for cable operator entry into wireless voice service and interactive transactional services. The infrastructure is built on AM fiber topologies, but additionally grafts on an optical transmission node (OTN), or a curbside cabinet that houses all equipment required to handle wireless voice, video, wireline voice and data traffic (see Figure 2). Located at the fiber termination point for each optical receiver in a cable system, the optical transmission node:

- Converts downstream optical signals to electrical form
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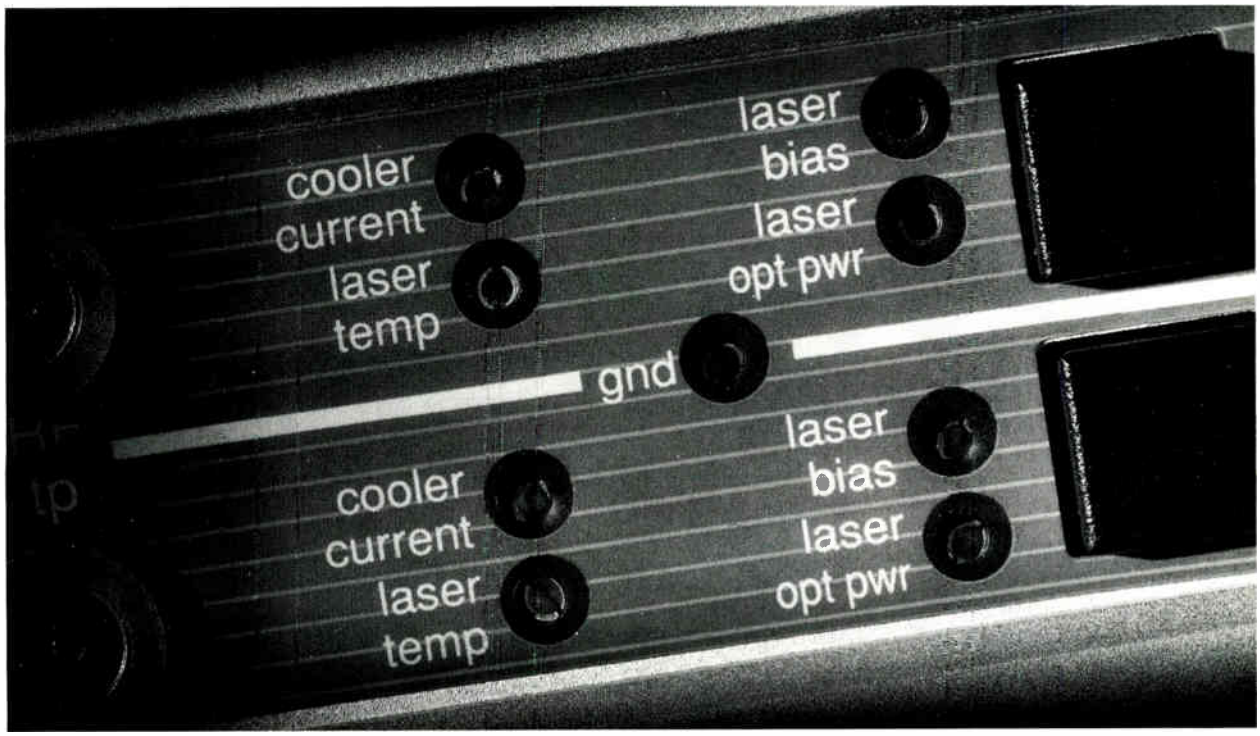

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- Serves as a radio transmitter site
- Provides SONET (Synchronous Optical Network) multiplexing and cross-connect functions for wireline traffic.

As indicated in Figure 2, the OTN houses AM receivers, AM transmitters for return path data and video signals and a personal communications network concentrator and receiver. The OTN is also seen as providing required cross-connect and multiplexing functions required to process digital traffic. It's important to note that although the current industry practice is to put AM receivers in a strand-mounted housing—a logical move to support today's core business—the industry will at some point also need to consider a cabinet as it weighs the merits of additional new businesses.

With this ring...

At the same time, the blueprint provides seamless integration of services for business customers, using a ring topology popularized by alternate access (metropolitan area networks) carriers to provide high-bandwidth voice and data transport to businesses, science/research and educational institutions. The infrastructure envisions the mating of an optical ring featuring optical route diversity, which provides commercial customers various configurations of network multiplexing capabilities.

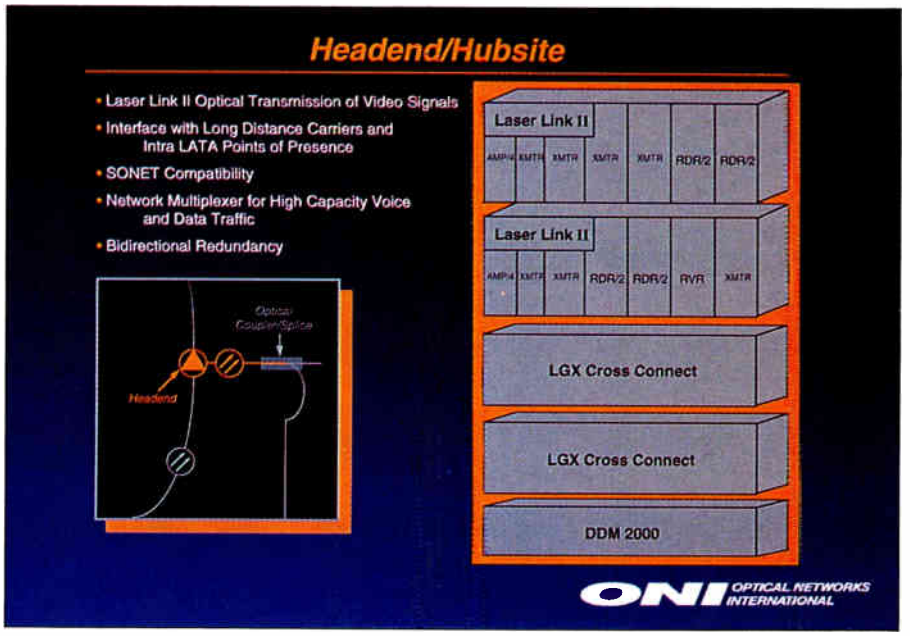

Figure 3

As part of the suggested design (see Figure 3), the headend becomes a sort of signal routing facility, containing cross-connect and multiplexing equipment required to hand long-distance traffic off to interexchange and local exchange carrier points-of-presence.

The model's key feature is the blending, in a single architecture, of network topologies suited to the differing needs of residential and business customers. Equally important is the adaptation of modern principles of network design in place of the traditional telephone industry local loop architecture, which featured feeder plant consisting of large cable bundles containing 1,200 to 3,600 pairs of wire typically branching out from a central office along four or five major routes using "bridged taps" to feed smaller distribution cables that terminated at customer homes.

In the late 1970s, though, telephone networks began to incorporate the "serving area" concept, in which a local exchange area was divided into quadrants, or serving areas. The idea was to minimize initial capital investment by allowing gradual installation of distribution cables as home density grew, instead of installing all distribution cable at once. The interface between the feeder and distribution plant was the "serving area interface," a network transition point that in some respects parallels the OTN and originally served as a manual cross-connect point, matching any single feeder wire pair to any distribution line. Using the serving area design, feeder plant was limited to 10,000 feet while distribution lines were about 2,000 feet.

With the advent of digital signalling, especially digital loop carrier (DLC) technology which multiplexes 24 individual voice channels into a single 1.544 Mbps data stream, the feeder plant terminated at a remote terminal capable of multiplexing and demultiplexing the signal streams and feeding individual subscriber lines. Although there is no technical reason that DLC technology must be based on optical fiber rather than copper media,

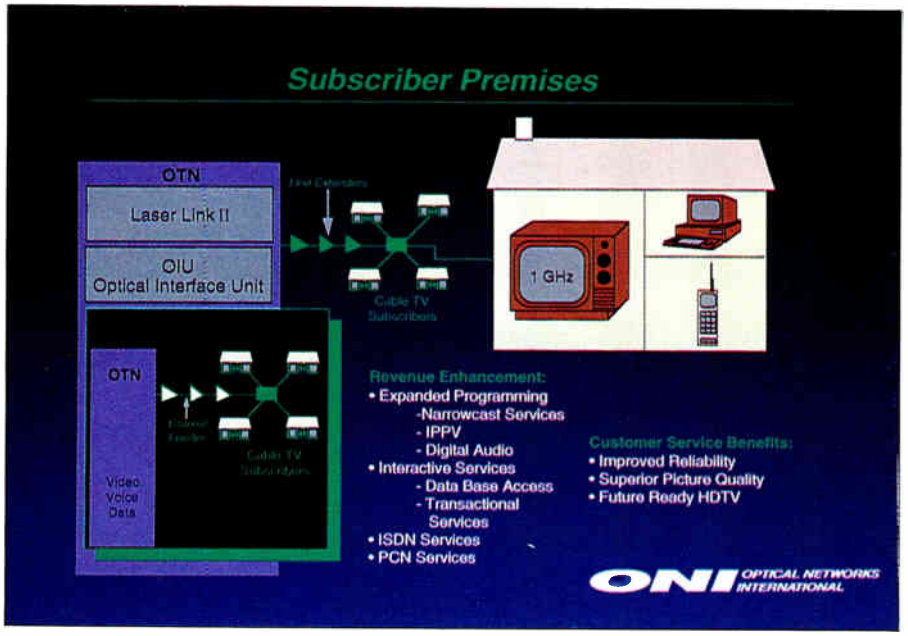

Figure 4

Not All Cable Is Created Equal.

It's a simple fact: a cable TV system is only as good as the fiber optic cable it's built with. And any sacrifice in quality can mean compromising durability, signal quality and consistency of performance. Which is why it's so important to specify Siecor cable instead of accepting just any cable or packaged system. Because our loose tube design insulates the fibers from the stresses of installation and of rigorous aerial environment. Aramid yarn strength members make the cable extremely light and flexible. Our cable doesn't require metallic strength members which can corrode or be damaged by lightning. And we can provide cable that's all dielectric or armored where additional protection is required.

What's more, Siecor offers cables utilizing Corning single-mode Titan™ fiber which is tougher and more durable than other standard silica fibers. With Corning's new fiber and our leading cable design, you get a rugged cable that's craft-friendly. Of course, our cable meets or exceeds all EIA, REA and Bellcore standards. And we offer a complete line of products and service including hardware, splice equipment, test equipment, training, consultation and splicing.

So get exactly what you need for your system with the knowledge you're getting the best. Call us at 800 762-2002, Extension 5992. Or write Siecor Corporation, 489 Siecor Park, Hickory, NC 28603-0489.

SIECOR

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Reader Service Number 39

the developing telephone industry practice has been to deploy DLC with optical fiber feeder.

The suggested flexible design incorporates the elements of modern telephone network design—based on full two-way transmission—with the cable industry's traditional need for unbalanced bandwidth and a transmission network optimized for broadcasting standardized messages from one point (the headend) to many other points (customer homes). The fiber-to-OTN architecture, while cost-effective today for entertainment video, provides a backbone for two-way traffic as well, because it mirrors the telephone industry serving area design and star feeder (CATV trunk) topology. At the same time, the model mirrors telephone industry state of practice by retaining use of copper media for the distribution (CATV feeder) portion of the plant and drops.

Business community served

On the other hand, the design also incorporates the latest thinking on optical network architecture optimized to serve the needs of business customers, whose needs for bandwidth are greater and whose requirements often include relatively simple point-to-point connections between their buildings or campuses and one of more interexchange (IXC or MANs) carriers.

Over the past several years, dozens of alternate access carriers (or MANs) have built optical fiber ring-star networks in downtown core areas to meet these needs. But these new ring-star structures differ in key ways from the older star networks that put the central office "at the center of the universe" and were optimized for voice rather than data.

For one thing, the new ring-star structures were designed as relatively low-cost, reliable methods for providing point-to-point digital circuits offering DS-1 (1.544 Mbps) and DS-3 (44.736 Mbps) channels for a relatively small number of customers with high needs for reliable service. Although the physical topology is that of a ring, the logical topology is that of a star network. Such networks can reach hundreds of kilometers in circumference, although most are far smaller, and serve up to 1,000 nodes—each of which can be thought of as being one termination point of a dedicated fiber path back to a headend. It's important to note that each customer attached to the ring-star has what amounts to a dedicated point-to-point link back to a cross-connect point. In general, traffic is not groomed on and off the network in an "add/drop" manner typical of bus networks found in the local area network arena.

Such a network architecture also facilitates provision of variable "bandwidth on demand" service and in a sense, mirrors the evolution of local data networks from bus to ring topologies. Where the bus architecture once was the dominant local area network design, it's clear that a migration is underway. Where workgroup LANs may continue to use a bus or star configuration, multi-building or campus backbone LANs are increasingly migrating to ring architecture, driven in part by emerging data communications standards such as the Fiber Distributed Data Interface. In a sense, ring topologies may be better suited to high-bandwidth applications in business settings and may increasingly be favored, not only by alternate access carriers but by local exchange carriers as well, at least to serve clusters of business customers located on business campuses or clustered in downtown areas.

The OTN (see Figure 4) might be

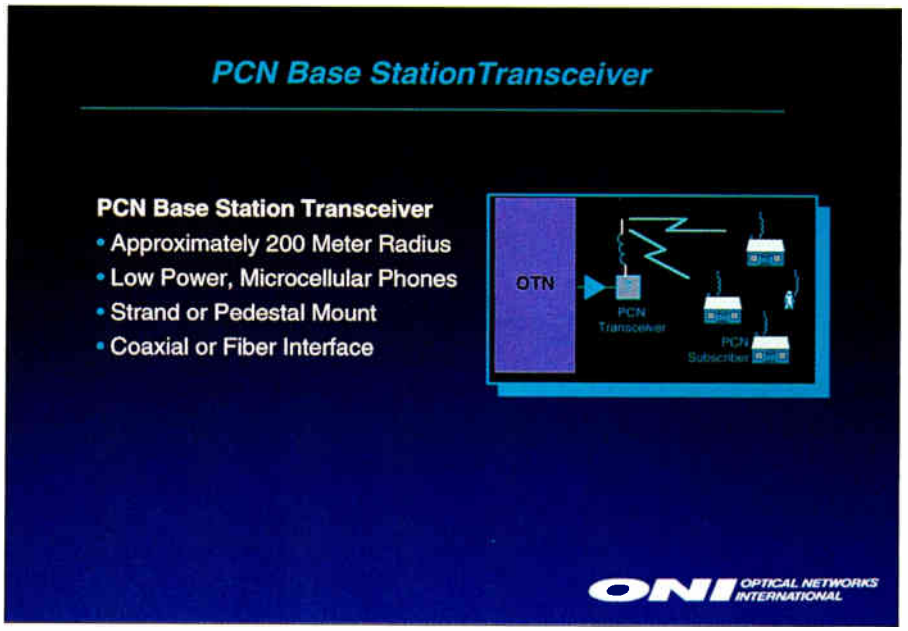


Figure 5

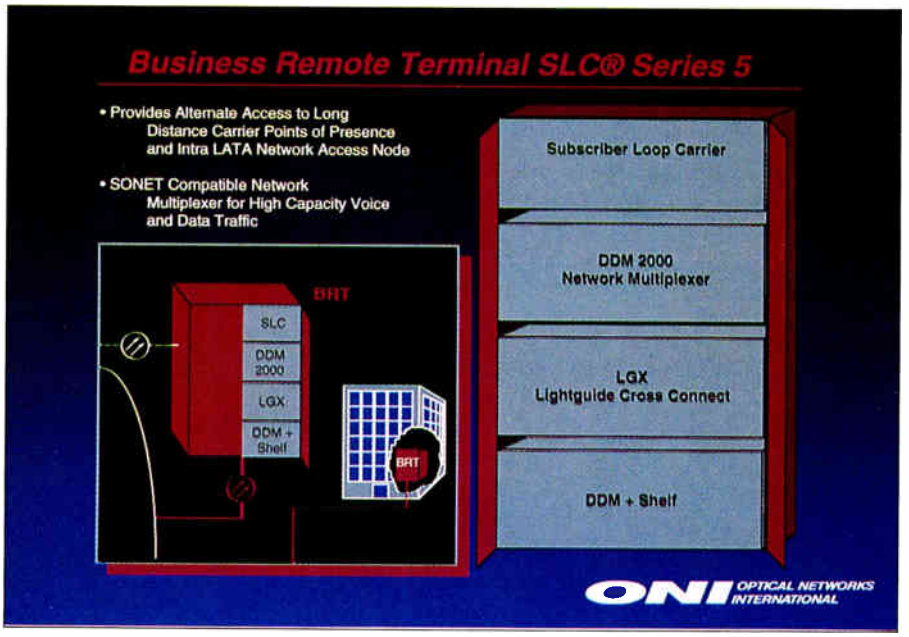
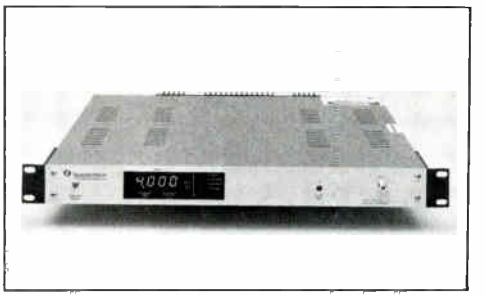


Figure 6

It begins with innovation... it takes knowledge and perseverance - then you have the solution.

Synchronous introduces the AMLT-1550 DFB Laser Transmitter, with proven technology and proven reliability.

The 2 or 4 mW Transmitter has a microprocessor controlled monitoring system and meets the industry requirements for 40 or 80 channels of AM transmission.



Bold Innovators of Applied Fiber Optics

For more information, please call 408-943-0222.

Synchronous Communications Inc.

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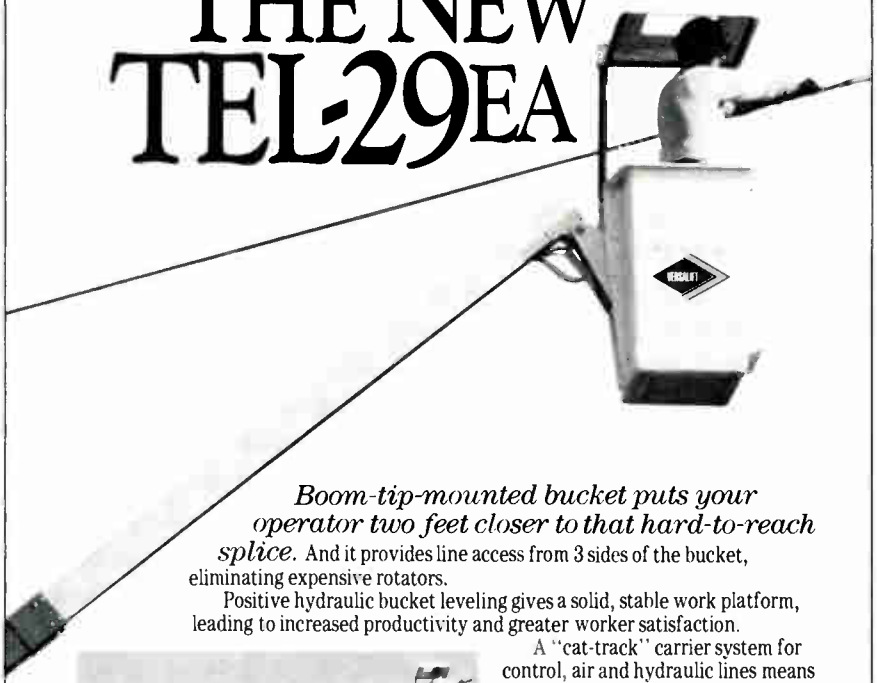
Reader Service Number 40

VERSALIFT

GAIN MORE SIDE REACH AND BETTER LINE ACCESS WITH THE NEW TEL-29EA



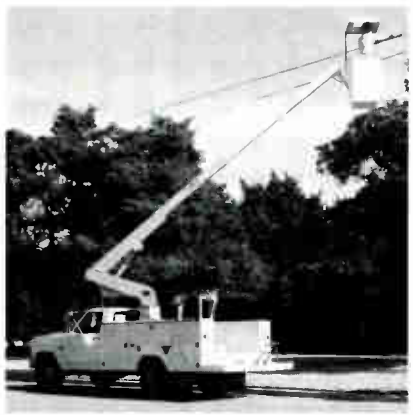
Boom-tip-mounted bucket puts your operator two feet closer to that hard-to-reach splice. And it provides line access from 3 sides of the bucket, eliminating expensive rotators.

Positive hydraulic bucket leveling gives a solid, stable work platform, leading to increased productivity and greater worker satisfaction.

A "cat-track" carrier system for control, air and hydraulic lines means less maintenance, more "up-time."

The VERSALIFT TEL-29EA can be mounted on any 10,500 dual rear wheel chassis with 60" C.A. and can be tailored to meet any aerial work requirement.

See your VERSALIFT Distributor for complete specifications, pricing and a demonstration!



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TIME MANUFACTURING COMPANY

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VERSALIFT

OPEN ARCHITECTURE

seen as the lynchpin of the residential network, initially serving as a relatively simple AM receiver location to support expanded programming options such as narrowcast services, impulse pay-per-view and digital audio. It might quickly evolve to support interactive and transactional services.

Ultimately, it might evolve to a more active role as an interface for integrated services digital network (ISDN) or PCN services as well. The PCN transceiver (see Figure 5) is a base station that might serve a 200 meter microcell, providing low-power radio access to customers using personal communicator handsets. It might also be strand or pedestal mounted and use either a fiber of coaxial cable interface.

Flexible wisdom

Some verification of the wisdom of installing a flexible architecture can be inferred from developing local exchange carrier state of the practice, which embraces a dual network thrust: the building of enhanced star topology networks to support broadband ISDN as well as the building of ring networks to counter the competitive inroads of alternate access carriers.

Indeed, as CATV architectures are getting more "star-like," telephone topologies are getting more "ring-like"—at least where it comes to offering business customers high bandwidth access to interexchange carrier points-of-presence.

In summary, the ONI communications infrastructure offers the cable operator a cost-effective, flexible platform for supporting today's entertainment video business while simultaneously creating the basis for tomorrow's potentially lucrative voice and data business. Importantly, the blueprint specifies the use of standard equipment already in existence or under development, minimizing risk and offering a vision of the future that is safely embodied in proven technology compatible with developing world standards.

Cable operators possess certain unique advantages—and possibly have some disadvantages—as they ponder a variety of new business opportunities. The ONI communication infrastructure, while cost-effectively supporting an operator's business today, also makes possible a gradual adaptation to integrate communications infrastructures that will be needed tomorrow. ■

Reader Service Number 41

WHAT'S AHEAD

SCTE

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

May 8 *North Country Chapter* "Interdiction, digital compression—video, digital audio and BTSC stereo" presented by Scientific-Atlanta. To be held at the Sheraton Midway, St. Paul, Minn. Contact Rich Henkemeyer, (612) 522-5200.

May 8 *South Jersey Meeting Group Chapter* "System design for CATV," "System powering design" and "Automated design." To be held at the Ramada Inn, Vineland, N.J. Contact Kevin Hewitt, (609) 886-7228.

May 8-9 *Dakota Territories Chapter* BCT/E testing to be conducted in Categories II, III, V and VII. Consecutive sessions to be held May 8 at the Ramada Inn in Pierre, S.D. and May 9 at the Radisson Inn in Bismarck, S.D. Contact Kent Binkerd, (605) 339-3339.

May 9 *New England Chapter* "FTF system architecture." To be held at the Sheraton, Boxborough, Mass. Contact Jeff Poitter, (508) 685-0258.

May 9 *Wheat State Chapter* "Standby powering." To be held at the Red Coach Inn, Wichita, Kan. Contact Mark Wilson, (316) 262-4270.

May 11 *Chaparral Chapter* "Headend alignment, troubleshooting and proof testing" with C.J.Harris of Scientific-Atlanta. To be held at the Holiday Inn in Clovis, N.M. Contact Brian Throop, (505) 761-6289.

May 14 *Razorback Chapter* Saturday installer certification tutorial to be held. Contact Jim Dickerson, (501) 777-4684.

May 14 *Chattahoochee Chapter* "Encryption and encoding of CATV signals." Contact John Williamson Jr., (404) 376-5259.

May 14 *New York City Meeting Group* BQ Cable Training Center, College Point, N.Y. Contact Rich Fevola, (516) 678-7200.

May 15 *Golden Gate Chapter* "Video and audio signals and systems," BCT/E category II. Contact Mark Harrigan, (415) 785-6077.

May 15 *Great Plains Chapter* "Proof of performance," with Chuck Thirlwall, Bob Richmine and Abe Workman. Contact Jennifer Hays, (402) 333-6484.

May 15 *Palmetto Chapter* "Installer certification program," with SCTE director of chapter development and training Ralph Haimowitz. To be held at the Swearingen Engineering Center, University of South Carolina, Columbia, S.C. Contact Melanie Burbank-Shofner.

May 15 *Penn-Ohio Meeting Group* "Interdiction and off-premise addressability." To be held at the Cranberry Motor Lodge, Warrendale, Pa. Contact Bernie Czarnecki, (814) 838-1466.

May 16 *Big Sky Chapter* "Fiber optics," with Mike Kaus of AT&T. Consecutive meetings to be held May 15 in Missoula, Mont. and May 16 in Laurel, Mont. Contact Marla DeShaw, (406) 632-4300.

C-COR® ELECTRONICS INC

C-Cor has announced its upcoming technical seminars, designed to instruct technicians in basic CATV theory, bring experienced personnel up to date on broadband equipment developments and instruct management personnel on upgrades, rebuilds and expansions. For further information, contact Kelly Jo Kerstetter at (800) 233-2267, extension 422.

May 21-23 Boston, Mass.

June 11-13 Harrisburg, Pa.

July 23-25 State College, Pa.

SIECOR

Siecor Corp. will sponsor a four-day, hands-on fiber optic training program designed for craftsmen and contractors who install, splice and test fiber optic cable in a cable television environment. Following is the date for the program "Fiber Optic Installation, Splicing, Maintenance and Restoration for Cable TV Applications." For info call (800) 634-9064.

May 20-23

July 9-12

Trade Shows

SCTE Cable-Tec Expo **June 13-16** Reno, Nev. Contact SCTE, (215) 363-6888.

IEEE Conference on Consumer Electronics **June 5-7** Chicago, Ill. Contact Diane Williams, (716) 392-3862.

The CABLE POLL™

Midwest CATV • CED • CableVision

Making spots run

Current ad insertion technology generally gets good marks from general managers, but executives who express dissatisfaction say they wish insertion hardware and software was more flexible.

According to the February 1991 Cable Poll of 400 system executives, 81 percent rate current insertion technology as either excellent or good. But frustration is evident in the remaining 19 percent, who give either poor or fair grades to suppliers of prevailing insertion technology.

Of those citing specific complaints, the biggest segment—35 percent—say they believe hardware and software is not responsive enough to changing requirements. Fifteen percent say staffing requirements remain too high while 13 percent charge that available equipment makes it difficult to generate accurate billing information.

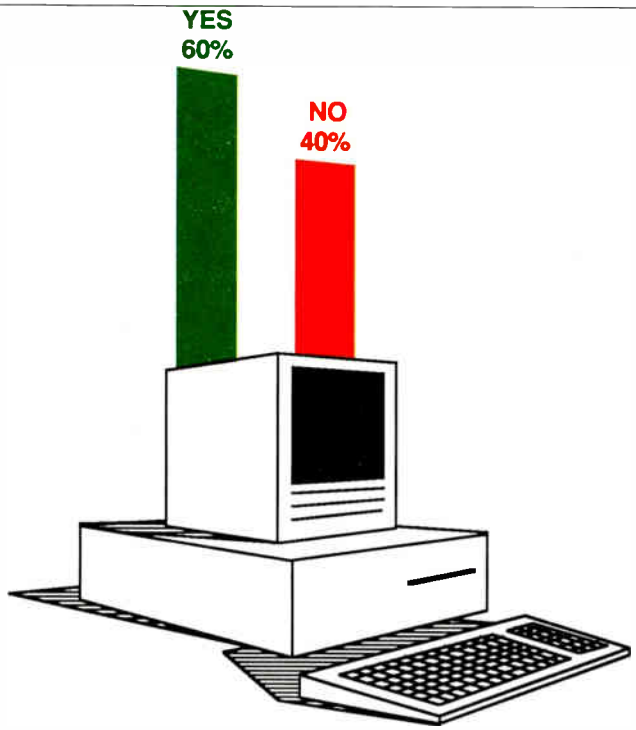
GMs at systems serving more than 50,000 subscribers are much more likely to complain about what they feel are inflexible restrictions in today's technology. Correspondingly, managers who work at top-25 MSOs are more inclined to feel the same way.

Yet concern about insertion technology appears to be a relatively minor stumbling block, GMs say. Indeed, 60 percent of GMs contacted by Cable Poll say they sell local ads. Most sell spots on between four and eight channels, although a healthy minority, 11 percent, sell time on more than eight. On the other extreme, 33 percent sell spots on fewer than three slots.

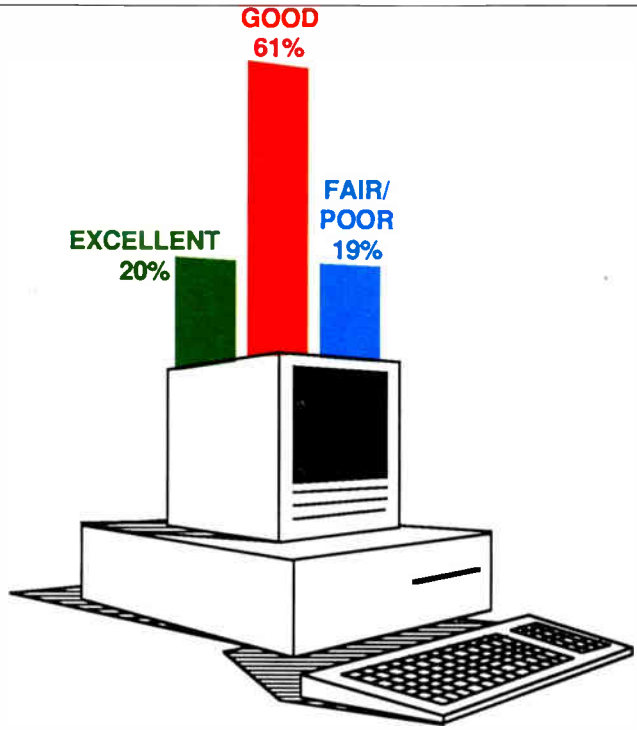
It's clear that of the revenues systems receive from selling ads, most come from local efforts. Half of the GMs say national cable reps contribute less than 10 percent of their annual ad business; only 6 percent report national reps accounting for more than 25 percent of ad revenues.

As might be expected, mid-sized and large operators were more apt to sell ads; 83 percent of the former and 88 percent of the latter market local spots. By contrast, only 43 percent of small systems—those with fewer than 10,000 subs—sell ads.

ESPN, CNN and USA Network remain the three most popular networks on which to sell local ads, GMs say. Other best-selling programmers include TNN, MTV, Headline News, The Family



Do you currently have local ad insertion capability?



Rate current ad insertion technology: How does it keep up with demands?

CABLE POLL

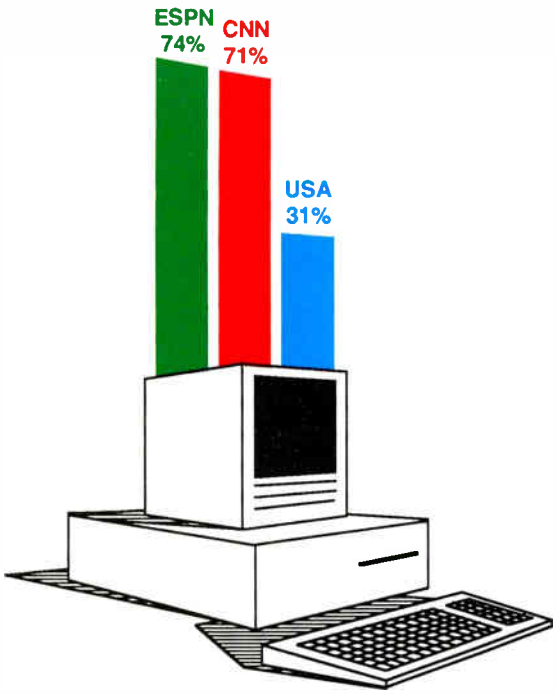
Channel and BET.

Even though operators are getting more successful selling local spots, 39 percent still don't have any full-time local ad salespeople. Eighteen percent have only one full-time ad salesperson, while 16 percent boast two and 17 percent employ three or more ad sales representatives.

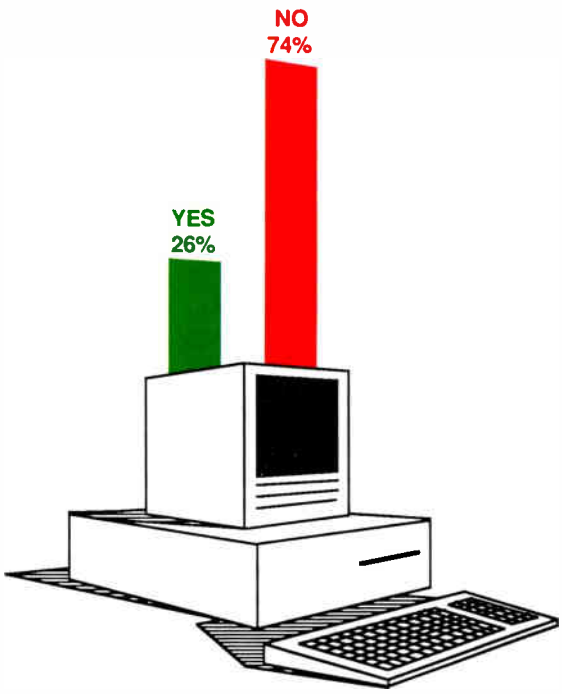
Managing classified ads reflects little difference. Most—64 percent—don't assign any salespeople to sell classified advertising. About 20 percent employ one staffer, 6 percent assign two and 5 percent have three or more classified ad sales employees.

Participation in area ad interconnects, meanwhile, is growing. One out of every four systems reports involvement in a local ad loop.

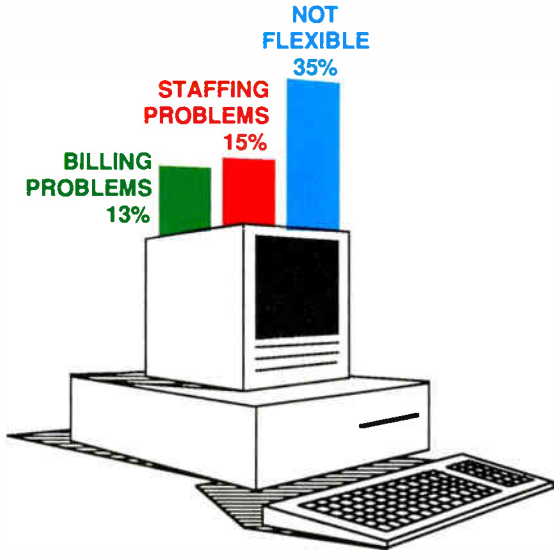
—By Chuck Moozakis



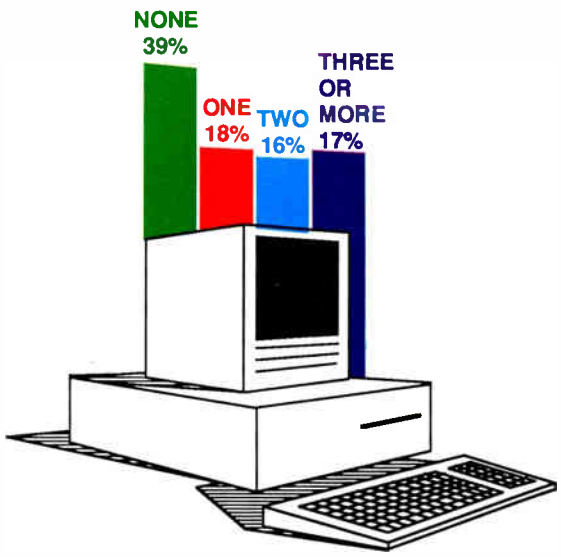
What are your system's three highest grossing basic networks for ad sales?



Does your system belong to an interconnect?



How has ad insertion technology not met your expectations? (Those expressing dissatisfaction)



How many full-time employees do you have selling local ads?

Prime's Pike takes NCTA Vanguard Award for science and technology

Dan Pike, VP of engineering for Prime Cable, was the recipient of the coveted Vanguard Award for science and technology. Pike is being honored for his leadership in focusing industry attention on phase noise and its effect on television quality.

Pike, a long-time member of the NCTA Engineering Committee, its HDTV subcommittee and the Society of Motion Picture and Television Engineers, is a board member at CableLabs and is a senior member of the Institute of Electrical and Electronics Engineers and the Society of Cable Television Engineers.

Other 1991 Vanguard Award winners are as follows:

- Distinguished award for leadership: **Robert Miron**, president, Newhouse Broadcasting Corp. and **Ruth L. Otte**, president and COO, The Discovery Channel.
- Award for young leadership: **Brian L. Roberts**, president, Comcast Corporation.
- Award for programmers: **John S. Hendricks**, chairman and CEO, The Discovery Channel.
- Award for associates: **Hal M. Krisbergh**, president, Jerrold Communications.
- Award for state/regional association leadership: **Dean A. Dayo**, president, Memphis CATV.
- Award for marketing: **Matthew C. Blank**, executive VP of marketing, Showtime Networks Inc.
- President's awards: **Ralph Baruch**, chairman emeritus, National Academy of Cable Programming; **James Chiddix**, senior VP of engineering and technology, American Television and Communications Corp.; and **June E. Travis**, president and COO, Rifken and Associates.

Widescreen receiver announced

As high definition television (HDTV) testing plans reach final stages in the U.S., **Thomson Consumer Electronics** has announced a European-version 16x9 widescreen television receiver, dubbed "Space System." The new set offers both existing television program formats and forthcoming EDTV and HDTV plans. In fact, Thomson officials foresee HDTV-compatibility via a plug-in module. "We view the Space System receiver in its beginning stage as a complentary system that will help pave the way for HDTV growth around the world," says Bernard Isautier, chairman and CEO for Thomson. "Our ultimate goal for television is to turn the family living room into a widescreen home theatre. That will best be accomplished by HDTV."

A widescreen receiver with digital sound will be introduced in Germany and Italy later this summer, company officials say, with a U.S. version targeted for the year 1992. "There has no absolute decision, and we would feel more comfortable if the industry and government had more definite plans for widescreen EDTV and HDTV in the United States," explains Isautier.

Priced at 35,000 French francs (roughly $6400), the receiver retails at "less than half" that of similar widescreen sets introduced in Japan. An option is also available to include both a D2MAC decoder and satellite dish, which enables direct reception of 16x9 programs transmitted by cable and direct broadcast satellite (DBS) systems. For more information on Thomson's new receiver, call (317) 267-6613.

Automatic call recognition

Telecorp Systems, Inc. has announced an addition to its audio response unit which enables automatic recognition of a calling party's telephone number. The module, called ANI (automatic number identification), will be available this summer.

The main advantage of the ANI module is order throughput—customers need no longer enter a number to complete a transaction such as pay-per-view ordering. "This development combines the advantages of ANI with those of ARU technologies," says Larry Bradner, CEO. "Addressable systems will especially benefit from this move, as it will significantly increase PPV order throughput." The ANI module is an adjunct to Telecorp's System 6000 ARU.

Telecorp has also announced enhancements to its PPV windowing technology for the System 6000 which allows cable systems to offer more movie choices by providing a higher level of flexibility in creating event windows. For example, a customer can order an event up to six days in advance. Similarly, multiple menus of event/movie selections can be presented to the caller at a time.

For more information, call Telecorp at (404) 587-0700, (800) 347-9907 or fax inquiries to (404) 587-0589.

Fiber optics newsletter

Fotec Inc. has announced publication of a quarterly fiber optics newsletter devoted to topics related to fiber optic application and testing. The latest issue includes articles on new technology, installation of fiber optic networks and a "Q&A" section on testing fiber optic cables.

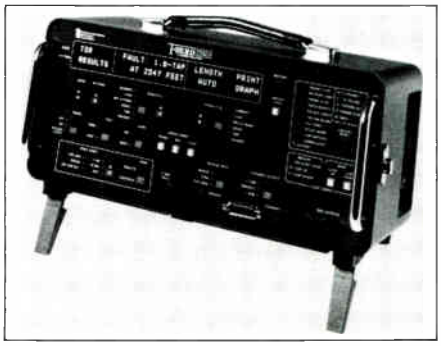
The newsletter, named "FOTN", is mailed quarterly to those interested in fiber optic communications technology. For more information, contact Fotec at (800) 537-8254 or fax inquiries to (617) 241-7810.

Pedestal hasp replacement

Moore Diversified Products Inc. has unveiled a new product designed to replace pedestal hasps. Called the Pedestal Hasp Replacement, the product slips over the metal pedestal edge and is then tightened. No drilling or adapting is required. The Pedestal Hasp Replacement is priced at $4.25. For further information, contact Moore at (800) 521-6731.

New TDR

Telecommunications Techniques Corp. has introduced a new fault location option for its portable T-BERD 209A and 211 T-Carrier analyzers. The



TTC's T-BERD 209A T-carrier analyzer

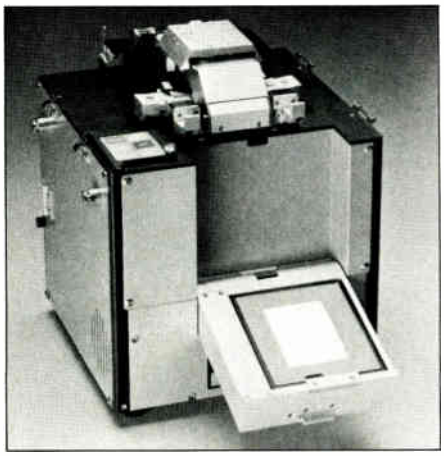
new time domain reflectometer (TDR) identifies and isolates cable faults such as bridge taps, opens and shorts by indicating the fault type and distance

on the front panel display. Also, the option can detect and determine the distance to other line impairments such as crimps, load coils, one side grounds, splits and water in cables. Automated and user-selectable configurations are available. And, a results storage and dual trace feature provides line analysis and comparison qualities.

For more information, contact Telecommunications Techniques Corp. at (301) 353-1550 or fax inquiries to (301) 353-0734.

Fuse multiple fibers

New from **Alcoa Fujikura Ltd.** is a portable fiber mass fusion splicer that

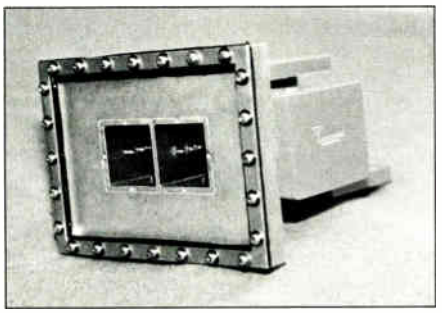


New Alcoa Fujikura Ltd.'s fusion splicer

automatically adjusts to altitudinal changes. The new pressure-sensing FSM-20R12 splicer automatically aligns and splices up to 12 optical fibers either in ribbon or bundled configurations. Ideal for making on-site splices of large numbers of single or multimode fibers in residential and commercial subscriber loops, the splicer offers a splice loss of less than 0.01 dB. Also included is a built-in 3.5 inch television monitor, which facilities visual monitoring of the prepared fibers ends—before and after the fusion process. For more information on the mass fusion splicer, phone (800) 866-2769 or fax inquiries to (803) 439-5160.

New antenna feed for two degree spacing

Seavey Engineering Associates Inc. has introduced an antenna feed capable of simultaneously receiving C-band signals form two satellites spaced as close as two degrees. The feed consists of a dual-aperture radiating element equipped with a pair of ortho-



Seavy Engineering's Multi-Sat 2° spacing

mode transducers which provide dual linear polarization on each beam. For more information, phone (617) 383-9722 or fax inquiries to (617) 383-2089.

New fiber adapter kit

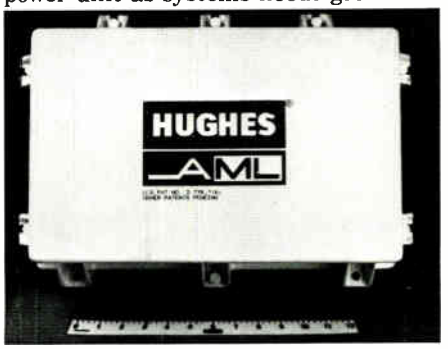
Meson Design and Development has announced the JU 828 Bare Fiber Adapter Kit. The kit comes with an

Meson Design & Development's JU 414

assortment of multimode or single-mode connector modules, clean-out wire and a JU 414 adaptor body. The unit is designed for use in acceptance testing of fiber before and after installation, or any time there is a need to temporarily connect a fiber to an OTDR, power meter, light source or other equipment. For more information, phone 800-45-MESON or fax inquiries to (607) 722-3945.

Compact outdoor transmitters

Hughes Aircraft Company has introduced a new family of compact outdoor transmitters, featuring small size and upgradeability. The new broadband transmitters have 80-channel capacity and are all solid state. The family includes four transmitters, each upgradeable to the next higher power unit as systems needs grow. The

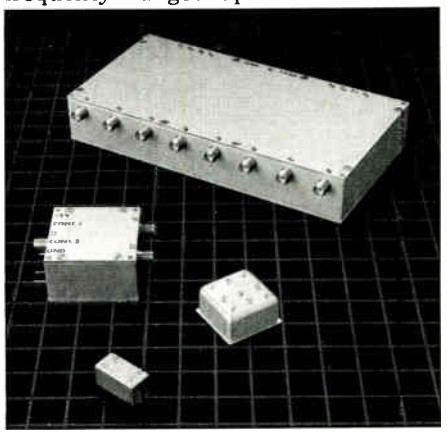


Hughes' outdoor compact transmitter

highest power model, the HCOT-114, has the capability of transmitting 40 channels over one 20-mile link or four 10-mile links with 53 dB C/N and 65 dB C/CTB. The other units, each approximately three dB down from the next higher model, are the COT-113, the MCOT-120 and the LCOT-119. A built-in pilot tone generator in each unit is compatible with all Hughes phase-lock receivers. For more information, phone (213) 517-6233.

New RF switch family

New from **JFW Industries** is a series of RF switches which include solid state power (100 watts, maximum), frequency ranges up to 3 GHz and



JFW Industries miscellaneous switches

faster switching speeds. The units are available in plug-in and stripline packaging. Internally terminated models are also available. For more information, phone (317) 887-1340 or fax inquiries to (317) 881-6790.

Smallest one ever?

Elan Cable Systems has begun

Elan Cable System's 4/16 Mbps unshielded twisted pair

shipping its new 4/16 Mbps unshielded twisted pair token ring media filter in volume after beta tests at both 4 Mbps and 16 Mbps. The integrated circuit is molded into a DB9 connector, making it the smallest unit known (company officials boast that it is the only known unit available which physically adapts to Apple workstations.) Elan is currently seeking distributors for the product in the U.S., Canada and the U.K. For more information, call (416) 853-0707 or fax inquiries to (416) 853-7664.

Fiber termination kit

Fibertron has announced availability of a complete line of optical cable/connector termination kits to assist users with fiber optic cable terminations. Until recently, company officials say, customers wishing to terminate their own fiber optic cables could choose to purchase kits from individual manufacturers for the specific connector or individual item needed. But with a variety of connector styles and configurations available, decision-making became more complex. To that end, Fibertron's connector termination kits contain standard and optional custom kits for specialized applications. Standard kits include buffer strippers, kevlar scissors, jacket strippers, scribes, crimp tools, glass polishing plates, epoxy and mixer kits, fiber cleaning tissues and a polishing pad. For more information, call (213) 690-0670 or fax inquiries to (213) 697-5360.

Exclusive agreement

Midwest CATV has announced an exclusive distribution agreement with **Wavetek RF Products.** Previously, Wavetek utilized a combination of distributors and representatives. In the agreement, Midwest will be a stocking distributor of selected Wavetek products.

"The agreement will work in conjunction with the Wavetek's existing rep network," says Jack Webb, group marketing manager for Wavetek.

Zenith, lodging industry ink deal

Zenith Electronics Corp. and the **Satellite Movie Company** have announced an exclusive agreement to provide proprietary interactive, integrated television products to the lodging industry. The agreement allows Zenith to expand its lodging product line with built-in SMC technology for interactive pay-per-view.

John Beasley, Zenith's manager of commercial products, commented that by the end of 1991 Zenith expects to offer a complete line of "New Horizons" commercial model color television sets that are compatible with Lodgenet systems.

The system eliminates the need for set-top converters and integrates the hardware and software necessary for pay-per-viewand guest services. The technology is housed within the television set. "Boxless technology is quickly becoming the focus of the entire lodging industry," says Tim Flynn, president of Sioux Falls, S.D.-based SMC.

—Leslie Ellis

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David Noel "Dr. Dave" Emberson passed away suddenly on April 1, 1991, leaving his wife Shirley, son Kenneth and daughter Judith. A Canadian cable pioneer, Emberson was involved in the industry since 1965 when he joined Neighbourhood Cable TV in Guelph, Ontario. Throughout his long career, Emberson was involved with both the operational and supply side of the CATV industry. Emberson was a relentless advocate of technical training and was instrumental in the formation of the Ontario Society of Cable Television Engineers, having served three terms as president.

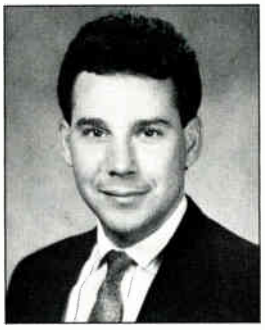
Emberson, a humorous, likable man, will be sorely missed by his friends and associates in cable television.

Promotions and transitions

Dan Carter has joined **Media Management Services (MMS)** Telecommunications Division to coordinate its activity in alternative access development. In his new role, Carter will assist cable clients as they seek to formulate and implement plans for the utilization of fiber optic networks to provide alternative access telephony services.

Ben Forte of **Western CATV** microwave systems sales force has been appointed new national sales representative for **Hughes Aircraft Company**'s AML signal distribution products. Forte will cover the entire U.S. and supplement the existing Hughes sales team.

Jeffry L. Harland has joined **Communications Engineering Inc.** as manager of implementation services. Harland's new responsibilities will include installation planning and management, resource scheduling, client liaison, vendor interface and manpower management. Harland comes from Triax-Kings Engineering, where he was senior studio engineer. Also, **Jim Conley** has joined CEI as a senior systems engineer. Conley's responsibilities will include system design and implementation, project management and vendor interface. Previously, Conley was VP of engineering at Powerhouse Studios Inc.



Clayton Dore

Clayton Dore has been appointed national cable sales manager at **Standard Communications**. Dore, with three years under his belt at Standard, was previously eastern regional sales manager. In his new position, Dore will focus on marketing and sales strategies in support of the CATV industry as well as oversee Standard's existing sales rep network.

Tom Pritchard has joined **Engineering Technologies Group** to direct the newly formed field engineering department. In his new role, Pritchard will oversee projects including fiber installation, headend alignment, system proofs, due diligence and effective competition studies.

Charles Merk has been appointed to VP of engineering for **Magnavox CATV systems**. In this capacity, Merk

Charles Merk

is responsible for all technical aspects of new product development and maintenance for the broadband electronics company. Merk succeeds now president and CEO Dieter Brauer. Prior to joining Magnavox, Merk was the VP of engineering at General Instrument's Jerrold Subscriber Division.

CableLabs has appointed **J. Scott Bachman** to director of technical operations projects. Bachman will be involved with the coordination and management of projects that have a direct impact on cable system operations, present and future. Previously, Bachman was director of engineering operations with Scripps-Howard Cable in Cincinnati, Ohio.

Thomas Duwit has been named acting general manager of **General Instrument's VideoCipher Divison**. Duwit will direct the operations of the VideoCipher Division's 1,000 employees at facilities in Calif., N.C., Mexico and Puerto Rico.

Andrew F. Holdgate has been named VP of **Mind Extension University**. In this newly created position, Holdgate is responsible for the network's communications and public relations efforts. Holdgate will relocate to Colorado from Ohio, where he was VP of public affairs for Warner Cable Communications.

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Cable: A self-renewing order

The amazing thing about the industry is how it continues to renew itself, become more exciting and open new horizons. It has been more than 15 years since satellites renewed an industry that reached a plateau as a cure for poor reception. Then came the explosion in new channels and the technology to deliver them.

Just a few years ago, it seemed we had reached the limits of coaxial technology. More channels or longer distances could only be attained at lower video quality. The trends in consumer electronics were going in the opposite direction. More quality was needed. This did not spell the end of growth for cable. It was simply pointed out a need. Cable's technology promptly came forward with a number of options.

Fiber

Cable was able to borrow and adapt the technology of the laser and fiber from the telco and communications industries. On top of that, cable added significant innovations that drove the technologies in directions never dreamt of by its originators. In fact, the first reaction of the original suppliers of lasers was to scoff at the idea of putting broadband AM signals on fiber. To them, it was obvious that the system would never be linear enough. Cable taught them a few tricks! Improvements in reliability, bandwidth and video quality were the result. The first innovations in a "fiber backbone" gave rise to 'fiber to the feeder" and other fiber-rich architectures. These facilitated still more innovation.

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

One GHz cable

Recently, the world's first full gigahertz cable construction project was announced by Time-Warner for its Queens cable system. This will be constructed before the end of 1991 in a portion of the system passing about 10,000 homes. About 4,000 subscribers will be connected. The current capacity of 75 channels will be doubled. This announcement has stimulated the industry.

One GHz cable will be achieved with the liberal application of fiber, innovative amplifier techniques and stretched in-home box technology. The cable itself supports this bandwidth. In a sense, this project finally harvests the full capability of the technology we've had in place for quite some time. This is the ultimate upgrade, because the cable will not support much more bandwidth expansion beyond this build-out.

One consequence of 1 GHz cable is that for such a system, there simply is no such thing as a "cable-ready television." While a television receiver does tune UHF frequencies approaching 1 GHz, it cannot handle a fully loaded spectrum reaching to those heights. A box is required to give subscriber access to the new channels.

As we add more fiber to our networks, cable becomes the logical choice for connecting the parts of a personal communications network (PCN). The key to PCN is relatively small cell sizes. This, in turn, allows the hand units to be built around low power transmitters, which makes them inexpensive, lightweight, small and dramatically improves operating time from each battery charge. The negative of many small cells is the need to keep them inexpensive. This is accomplished by making the cells simple gatherers of energy which is processed at the headend. This centralized processing allows equipment sharing and economic efficiencies.

Video compression

Less than a week after the announcement of the 1 GHz plant in Queens, CableLabs held a press conference to publicize its project in video compression. CableLabs will lead the way in determining a standard for the application of this technology to cable. A Request for Information (RFI) was sent to a couple dozen companies. In addition, a consortium of CableLabs, Scientific-Atlanta and General Instrument was created. This announcement complements the effort in Queens. When video compression is added to a system with 1 GHz capacity, hundreds of channels become possible.

One of the most exciting applications for hundreds of channels in a cable system is near video on demand (NVOD). The basic idea is to repeat the most popular movies every "X" minutes. When "X" is shorter than the movie's length, more than one channel is required. A typical number discussed for "X" is 30 minutes. A two-hour movie would thus require four channels. "X" is really a marketing decision. The hardware should support different values for "X"—even different values at the same time. That way, the most popular movies can be repeated more often than the less interesting titles. In fact, "X" can become hours or even days for low interest or old movies.

For the most popular movies, though, my suggestion is that the value for "X" be slightly less than the average drive to the local video store.

High definition television

HDTV is yet another exciting future service. HDTV in cable got a boost at the recent CableLabs conference, where the Labs announced that it would coordinate the first regularly scheduled HDTV service by the end of 1991. This will be accomplished with the cooperation of the proponents of HDTV standards. As many as wish to participate will be accommodated. At first, the regularly scheduled service will take place once a week. It will progress to once a day and then to more aggressive scheduling as appropriate. Viewing equipment will be set up in public places for the purposes of promoting both HDTV and the cable industry.

Looking back, I can't remember a recent year when there was so much excitement from a technological point of view. Fiber, gigahertz hardware, video compression, off-premises and PCN are upon us suddenly. For a technologist, there can be no better place than the cable industry. ■

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