CED

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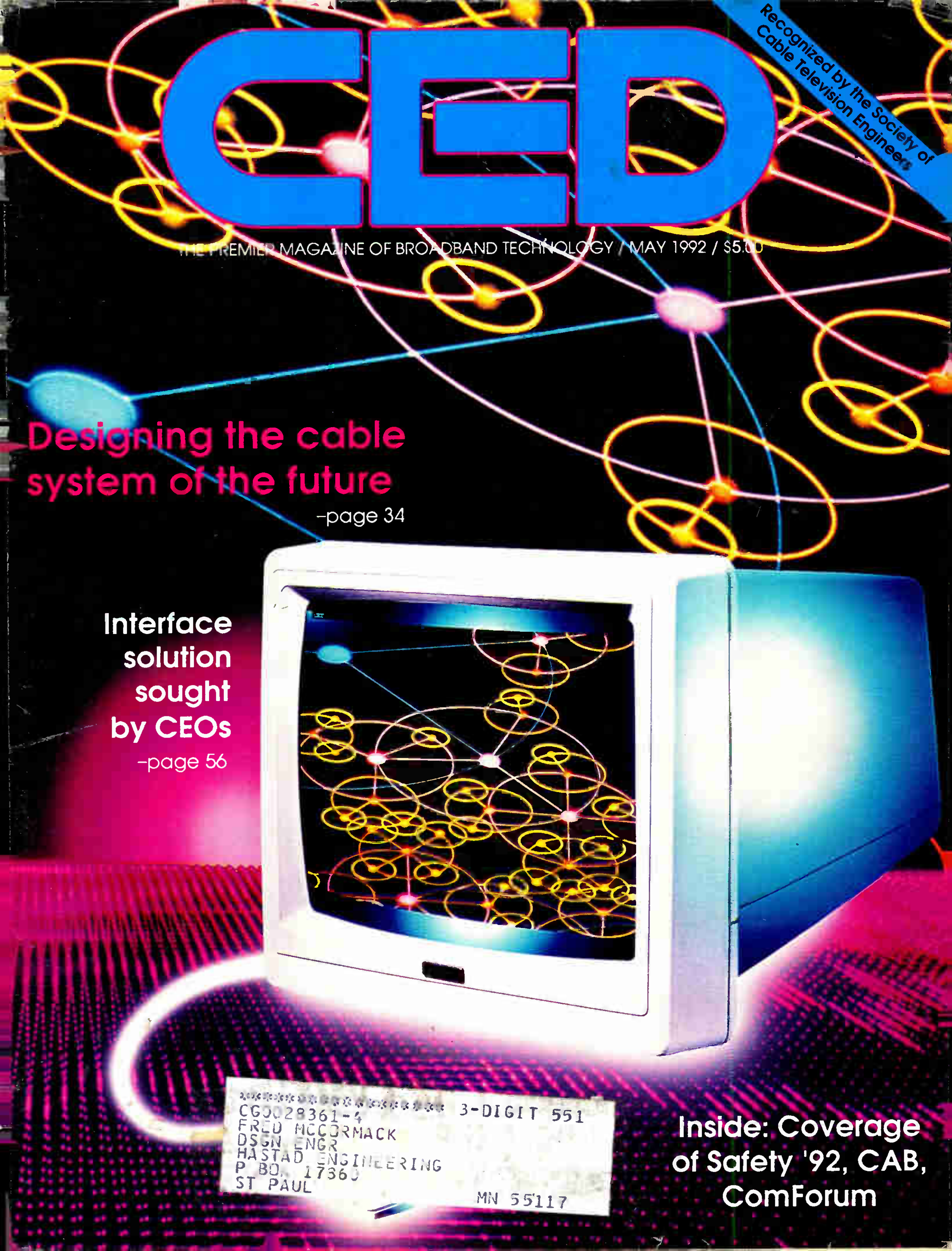


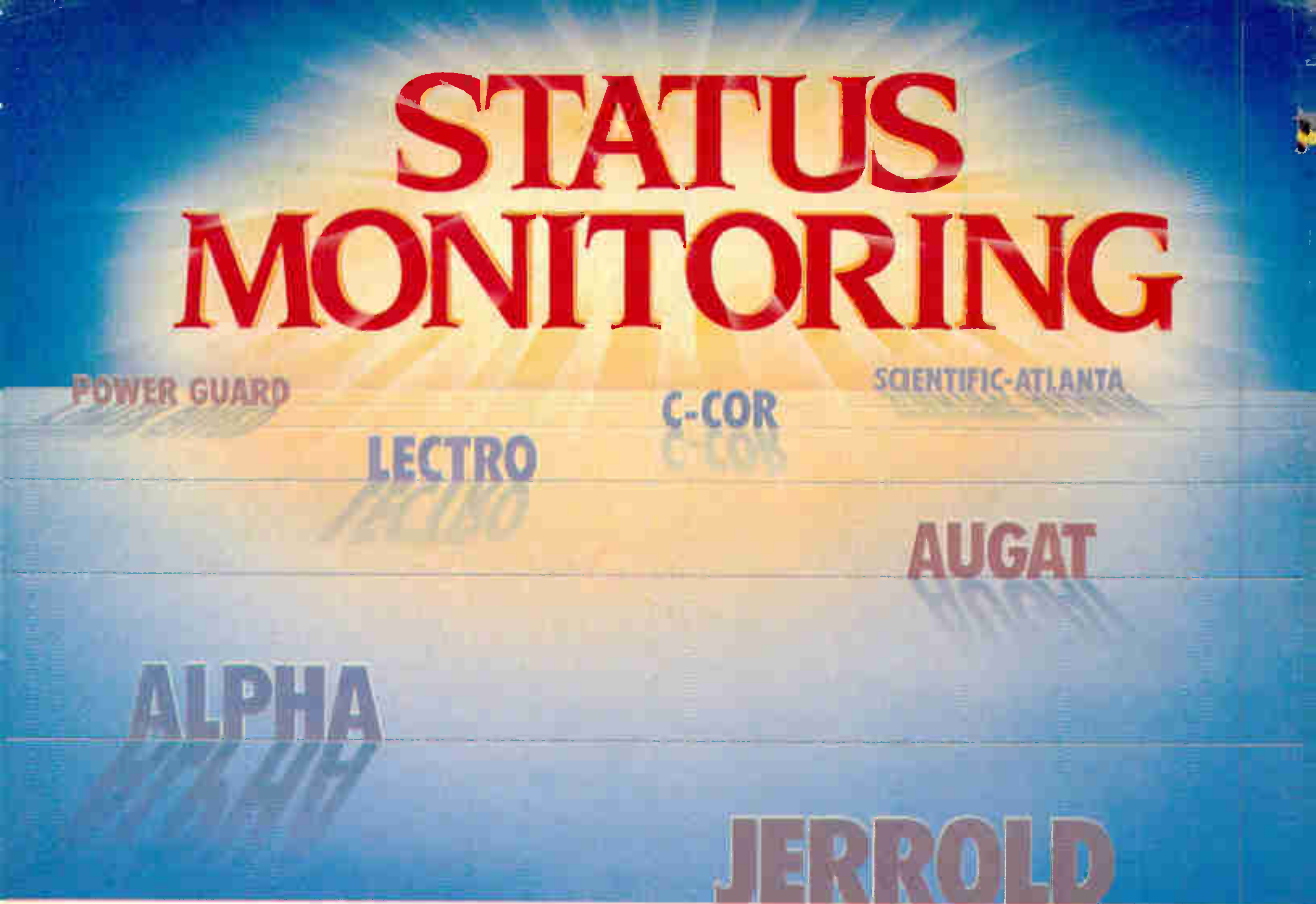
Designing the cable system of the future

–page 34

Interface solution sought by CEOs

–page 56

Inside: Coverage of Safety '92, CAB, ComForum



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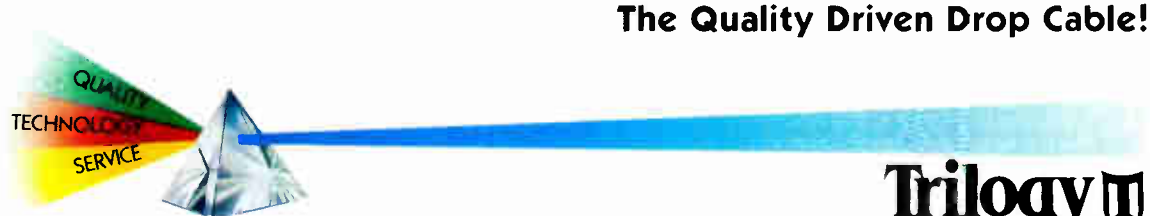

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May 1992

CED

Volume 18, Number 5

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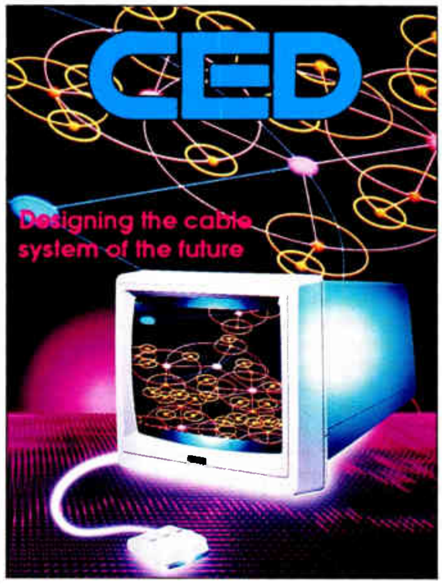

About the Cover:
Future-proofing your system with rings and hubs. Photo by Steven Hunt for The Image Bank.

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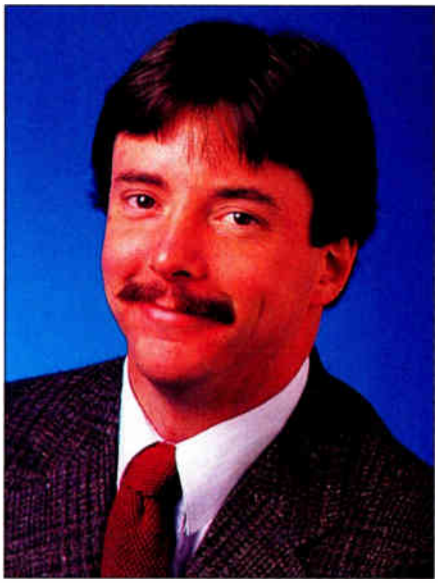
Circle Reader Service No. 3

Cable's message hits the mainstream

A fundamental shift in thinking is occurring within the nation's business writing corps regarding which industry—cable or telephone—will lead the country into the 21st century by deploying an advanced telecommunications infrastructure first. This shift in thinking will likely have a profound effect on the way the cable industry is perceived, and perhaps how it's regulated.

This basic turnabout couldn't be stated any more clearly than it is in the cover story of *Forbes* magazine's April 13 issue, where the writer admits he was simply "wrong" about earlier prognostications that cable networks were doomed dinosaurs. Cable operators like ATC, together with CableLabs and vendors like Jerrold Communications, managed to convince George Gilder, that cable is the likely candidate to do that. This is a feat in itself, considering that Gilder has long been a believer that telcos would bring this nation its network of the future.



Gilder was shown how CATV networks will benefit from the installation of "broadband pipes" (fiber optic links, to you and me) out to nodes serving a small number of homes which in turn feed short, coaxial runs to each home. Telcos, on the other hand, would have to start from scratch to do the same thing. Readers of *CED* already know this.

It must be gratifying to people like Jim Chiddix, Dr. Richard Green and Hal Krisbergh to know that the cable "message" has finally gotten out beyond the industry trade magazines and into the mainstream. Cable operators are sitting in the catbird seat (to borrow a phrase), because, quite simply, they can adopt and implement virtually any broadband technology faster and more cheaply than telephone companies.

Furthermore, by adopting this "narrowcast" approach, cable systems can emulate (and eventually nearly duplicate) the telco switching network to provide video-on-demand-like service. And now that cable companies are aggressively entering the telephone competitive access business and exploring personal communications, they're beginning to eat away at the telcos' lunch. The telcos should be running scared.

But therein lies potential danger. To date, the industry's powerful lobbying forces have managed to keep the telcos' efforts to offer video entertainment in abeyance. While it seems certain cable will soon feel the slap of some form of re-regulation, it's virtually certain that telcos will get no regulatory relief to enter the content business. But that won't last forever. It won't be long before most or all of the barriers that keep telcos out of video and information services are torn down—and that's when the real competition will begin.

Cable operators had better not turn complacent simply because they have the upper hand today. The regulatory playing field is going to be altered by a Congress and FCC that prefers to see competition. Get ready: The time to improve customer service and network reliability is now. The cable message has gotten out; it's time to live up to the promises.

Roger J. Brown

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Circle Reader Service No. 4

CableLabs, ATSC quarrel over ghost tests

Ah, the joys of committee work. It seems that the Advanced Television Systems Committee, after soliciting input on optimum ghost canceling reference signals from Cable Television Laboratories, the National Association of Broadcasters and a number of other scientific groups, managed to strike a nerve recently with the normally staid CableLabs.

After hustling the Labs into a speedy turnaround on its ghost canceling test results, which Labs officials met, the ATSC apparently edited out major portions of the Labs' report. The problem with that, says CableLabs' Vice President of Clearinghouse Mike Schwartz, is that the ATSC left intact only that information regarding "the best" proponent, which turned out to be the Sarnoff/Thomson cooperative. Edited out was crucial information stating the need and reasons for continued study.

The NAB had previously selected Philips as its "winning" choice for a ghost cancelling reference signal and made its selection public. Philips officials were elated and the company has already begun marketing the Vector video echo canceler to cable operators and broadcasters.

But more to the point: Why the discrepancy between the CableLabs and NAB test results? "I don't know," says Schwartz. "I can only guess that we (CableLabs and NAB) had different tests in mind; we each performed different types of testing."

Because of the unauthorized editing, CableLabs promptly consulted legal counsel and fired off a pointed letter expressing its distaste in being edited so heavy-handedly.

At press time, the ATSC had rectified the touchy situation by appointing a seven-member task force comprised of representatives from NAB, CableLabs, the National Cable Television Association, Public Broadcasting Service, MSTV and ATSC. That action prompted CableLabs to retract its formal letter of complaint.

The group will continue to study ghost cancelling until the middle of May—which represents a six-week extension. "The important thing here," Schwartz emphasizes, "is to select the *best* standard. That means allowing an adequate time frame in which to initiate good scientific research."

Specifically, CableLabs has argued that it is practically impossible to choose the best ghost canceling reference signal without regard to the specific hardware used to utilize that signal. In fact, it believes the lab and field tests were "at least as much a function of the particular hardware tested as it was a measure if the characteristics of the GCR signal," according to CableLabs' report.

Therefore, CableLabs "believes it is essential that the committee insist that both Sarnoff/Thomson and Philips provide full disclosure of the computational algorithms and schematic diagrams for the prototype hardware tested" in order to make analysis of the test results possible, said the report.

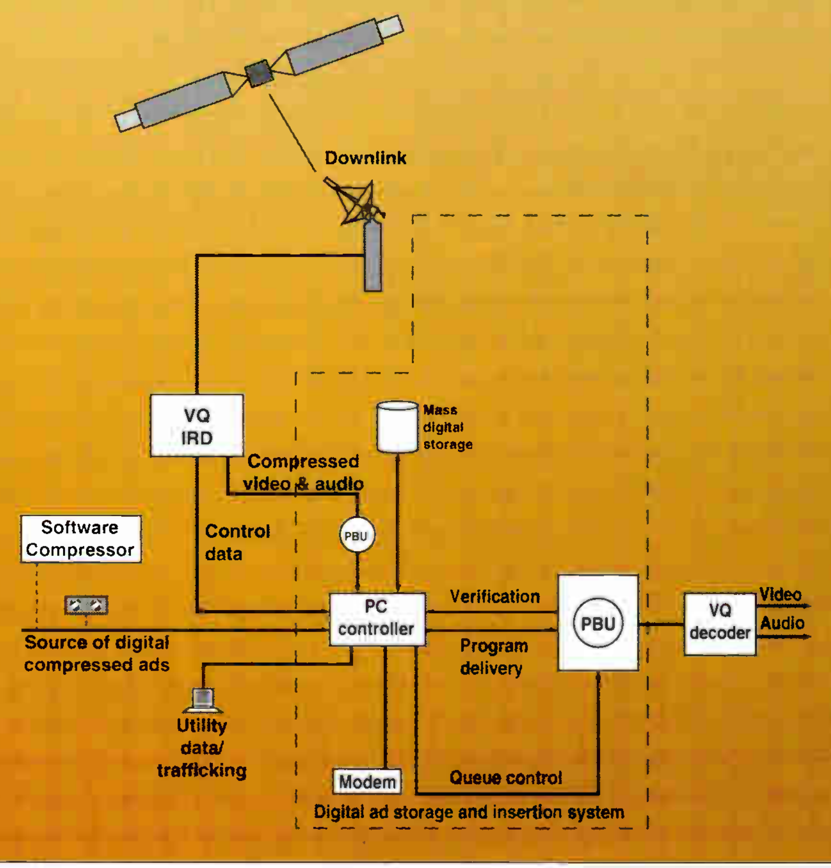
In addition, CableLabs identified some nine other issues that should be addressed before a specific GCR standard is adopted for use by broadcasters and cable operators.

S-A sells digital satellite ad insertion system to Mediatech

Scientific-Atlanta entered the commercial insertion hardware and software business last month when it sold its first satellite-delivered, digitally compressed ad insertion system to Mediatech, an ad duplicator and distributor based in Chicago. The announcement was made during the National Association of Broadcasters convention in Las Vegas.

The agreement calls for S-A to provide an end-to-end digital delivery, storage and insertion system to Mediatech. The system, which is scheduled to be operational in early 1993, is based on S-A's vector quantization compression scheme and promises to reduce the time needed to distribute ad spots while at the same time improving their quality. The

Overview of a VQ-based digital commercial insertion system



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system will utilize existing S-A satellite transmission, conditional access and digital compression technologies.

Mediatech presently delivers national spot ads and syndicated programming via videotape, which suffers from a reduction quality as copies are made during the editing and distribution process. By moving to satellite distribution of digital information, quality should be improved dramatically, said Tom Baur, chairman of Mediatech.

Baur predicted this type of system will "revolutionize" the way signals are distributed to broadcast and cable outlets. For the first time, quality equal to that of first-generation masters can be distributed, which will be "noticeable to the eye," said Baur. Mediatech now delivers ads to regional or national cable facilities, which in turn copy them and distribute them in a variety of ways.

The S-A system promises to interface seamlessly with existing commercial insertion hardware, according to S-A executives. Storage of up to 2,500 commercials will take place in a mass storage unit about the size of a small desk.

In related news, S-A plans to unveil 8600 set-top terminals compatible with some older Jerrold and Zenith scrambling schemes. Company officials believe the 8600's advanced on-screen graphics, messaging capability and enhanced security will make it attractive to operators who are looking to replace older set-tops from other manufacturers. It is the first time S-A has ever offered units compatible with Jerrold or Zenith scrambling methods. The earlier 8590 unit was compatible with Oak, Hamlin and Sylvania.

The new units are already being tested by Jones Intercable and are presently being rolled out in Continental Cablevision's Rolling Meadows, Ill. system.

S-A will also show its new System Manager 10 system, which represents a switch from a Hewlett-Packard mini computer to IBM PC or compatibles.

Jerrold offers "digital-ready" laser

Cable operators' preference for a "narrowcast" approach to video signal delivery has led Jerrold Communications to introduce a new 750-MHz "digital-ready" distributed feedback laser during the National Cable Show in Dallas this month.

According to David Robinson, director of Jerrold's Cableoptics unit, the laser will deliver 80 channels of analog video while passing up to 750 MHz of bandwidth, making it compatible with systems that plan to offer 550 MHz of analog video and a tier of digital services.

The lasers are hand-picked and represent only the most linear DFB devices available from Ortel Corp., manufacturer of Jerrold's laser, said Robinson.

Other products scheduled for debut by Jerrold include a high-power "Super Starfire" DFB laser that reportedly offers 4 dB better carrier-to-noise than Jerrold's best product to date and outperforms a YAG laser in a dual-fiber configuration. Robinson said this device is meant for niche applications of long-haul fiber links. He said the device would deliver 80 channels of video over a 12 dB link and offer 54 C/N at the receiver.

And finally, on the headend side, Jerrold plans to debut the commercial DigiSat integrated receiver/descrambler for use with digitally compressed video. The DSR-1000, which will be available in the summer, interfaces with conventional AM modulators and Digi-Cable headend products via its baseband and digital outputs. It will feature an automatic re-tune capability for syndex applications.

TV Answer, IN in patent spat

In what could be a precursor to the development of the nascent interactive television industry or perhaps a tempest in a teapot, TV Answer and Interactive Network (IN) have traded barbs over patent rights to wireless interactive transmissions.

IN President David Lockton raised TV Answer's dander during a presentation at the Home Media Expo at the end of March at which he announced a new patent that would allow video game players to simultaneously compete against each other. Lockton said the best way to provide an interactive service is by a wireless method "protected by the IN patents."

TV Answer shot back with a "cease and desist" letter, claiming that IN's patent covers delayed use of telephone lines, not a real-time wireless method.

At about the same time, TV Answer announced it has contracted to build an $8.5 million national switching center that will be used to register consumer transactions as they pass through the TV Answer system. In addition, the company announced that national retailers J.C. Penney, Bose Express Music, CUC Inc., 800 Spirits and 800 Flowers will add TV Answer's interactive service to their direct marketing programs.

Jottings

This should come as no surprise, but the advanced television testing schedule has slipped by a few months. The latest word out of Washington is that the final proponent will be done testing on September 18 and the final report will be adopted in mid-December. Then the field test portion of the lenghty process can begin. . . A new fiber architecture incorporating both high-power YAG lasers and DFB devices has been developed by **Optical Networks International**. Dubbed "Star-star-bus" for the topology it creates, the architecture was developed to design cost-effective plant today that will support advanced services and provide serving areas of 500 homes per node (for details on this architecture, please see page 26). . . After a couple of delays, **Hughes Communications** successfully launched Galaxy V, the next-generation satellite dedicated to cable programming. Galaxy V will begin operations May 8 at 125 degrees west longitude. It replaces Westar V, which will be retired. . . **Tele-Communications Inc.,** continuing its aggressive testing schedule of new and emerging services, announced a personal communications services trial with McCaw Communications in Ashland, Ore. The six-month trial is reportedly the first to sell combined residential and local wireless service to the public. Two hundred residents have been signed up for one of two service plans. Also, TCI announced that the joint TCI/AT&T/US West 18-month market test of Viewer Controlled Cable Television is proceeding as planned. The VCTV center was scheduled to be operational in April and the necessary commitments from studios, cable programmers and audience tracking firms were in place. . . Magnavox CATV Systems Inc. has changed its name to **Philips Broadband Networks Inc.** to better reflect the corporate ownership. Magnavox has been a division of Philips Electronics N.V. since 1974. Philips will continue to apply the "Magnavox" name to its distribution products. . . .

By Roger Brown

Revised HDTV timetable

When high definition television finally becomes a day-to-day staple of American life, several milestone dates will be remembered. Certainly the month of March 1992, will in retrospect appear to be one of those times. With the testing of six proponents almost half completed (three of the six proponents have been tested at the Advanced Television Test Center and CableLabs test facility), several other events of note took place.

First, on Monday, March 23, 1992, one proponent, General Instrument (DigiCipher) gave a live demonstration of a broadcast of its system over a local television station as well as a local cable system. This was not a scientific test, it simply was a public demonstration.

The event was attended by an impressive array of dignitaries, politicians and regulators. To say that they were impressed with how far digital technology has come would be a gross understatement. While everyone was pleased at the demonstration and the efforts that this one vendor put into its system, they were all reminded that there are several other systems (and at least two other digital systems) that still need to be tested.

Just two days later, the FCC Advisory Committee on Advanced Television Service held a meeting where it received the fifth interim report of that body for review prior to submitting it to the Commission. The room was literally overflowing with "interested parties." The interim report itself is very interesting to read, as it deals with several specific issues that are of great interest to those who have followed this proceeding.

By Wendell Bailey, Vice President, Science and Technology, NCTA

And then there were five

One interesting action that took place was the formal withdrawal of the first system tested, that being the "Advanced Compatible Television." Advanced Compatible Television is an analog system proposed by the Advanced Television Research Consortium, which is made up of the David Sarnoff Research Center, North American Philips, Thomson Consumer Electronics, NBC and Compression Labs. This same consortium has decided to concentrate its future efforts on its second proposal: Advanced Digital High Definition Television (AD-HDTV).

The most important action at this meeting might have been a recommendation by the advisory committee for the formation of a "special panel." The panel will receive data and analysis from the test center and convene to judge which of the proponent systems should be forwarded to the FCC as its recommended system for the establishment of an HDTV standard.

This special panel will meet starting the first week in January 1993 (assuming, of course, that all the test dates stay on schedule) and will deliberate until it has made a conclusion. This is expected to take approximately one week. The meeting will be open to the public, and will be conducted in a formal style. Each proponent will be allowed to place one observer with no voting status on the panel. Other non-voting members will include the FCC staff and certain advisory committee member companies.

The voting members will primarily be people with technical expertise and a history of serving the committee throughout its deliberations, who have a relationship with the advisory committee membership. The panel will be chaired by Robert Hopkins, executive director of the Advanced Television Systems Committee. Alex Felker of Time-Warner will act as vice chair.

In addition, advisory committee chairman Richard Wiley has formed a "Field Test Technical Oversight Committee" which will supervise and oversee the verification tests in the field. The field tests are meant to prove or verify that the chosen proponent system will perform in the field the way the laboratory tests have predicted. When these tests are concluded and the results turned over to the advisory committee, a final report will be prepared and sent to the FCC.

From the time the special panel submits its recommendation for a terrestrial standard to the parent Advisory Committee, the FCC will have begun working on the regulatory and policy issues. When the final report (which includes data from the field tests) is sent to the FCC by the ACATS, it will put the pieces together and hopefully by June 1993 issue a report and order establishing a high definition television standard for the United States.

Between now and then, the industry must work hard to make sure that the issues that affect cable operators are completely and thoroughly documented and covered by all committees that have input to this final decision. As the end game progresses, we must make sure that critical issues are dealt with, such as the economic impact on cable television headends and on our programmers.

Also important is the issue of robustness of any chosen standard and its ability to transmit properly on a cable television system, as well as the issue of whether or not the chosen proponent system will support conditional access control codes.

An entire can of worms is related to the issue of simulcasting and how the FCC might adopt that policy. In a current rulemaking proceeding before the FCC on the definition of simulcasting for HDTV, one of the issues is how much difference there can be between the broadcasters' NTSC channel and the newly granted HDTV channel.

Must-carry obligations

While the cable industry does not wish to debate the merits of how much differentiation should be allowed, we do care about how the Commission and its ruling deals with the issue of must-carry and any obligations that the cable operator might have to carry multiple channels.

It seems that after nearly five years of discussion and debate about HDTV, we might soon be able to see the light at the end of the tunnel. The only problem then will be who will deal with all of the follow-up work that must come after a decision of this magnitude, in order for there to be a viable transfer of this technology to our industry. It looks to me like there will be plenty of work on picture quality for years to come. CED

ONI OPTICAL NETWORKS INTERNATIONAL

Optical Network News

The following highlights are from Optical Networks International's quarterly newsletter.

■ ONI's new architecture extends fiber's reach

ONI has developed a new fiber architecture designed to cost-effectively drive fiber deeper into cable systems. The Star-Star-Bus-500 (SSB-500) is a migratory architecture that enables operators to build cable plant today serving 500 homes per node at cost parity with FTF systems serving 2500 homes per node. The SSB-500 positions cable systems for introduction of new services with extensive interactive requirements.
(Visit ONI's Booth #1614 and see related story in the May, 1992 issue of *CED*)

■ AT&T to stage digital compression theater

AT&T will be unveiling its NTSC digital compression system at the May NCTA show in Dallas, with a demonstration in AT&T's new digital compression theater. AT&T's digital compression system was first announced to CableLabs in a response to their RFP on digital compression.
(Visit the AT&T Theater at Booth #1623.)

■ Alternate Access and Digital Transmission presentations at NCTA

Be sure to mark your show calendar for these important technical sessions:

Monday, May 4	3:15 p.m.	*Technical Implications of Alternate Access* Andy Paff, ONI
Wednesday, May 6	9:00 a.m.	*Digital Transmission Fundamentals for Cable Engineers* Ed Callahan, ANTEC (Carl McGrath, AT&T, co-author)

■ ONI demos new automated fusion splicer

ONI will be demonstrating the new Type-35SE fusion splicer from Sumitomo at the May NCTA show. This latest version of fusion splicers reduces splicing time and provides newly automated functions which ensure quality splices every time. The Type-35SE features an enhanced user interface, automatic atmospheric arc compensation, electrode monitoring and self-diagnostics.
(See a demonstration in ONI's Booth #1614)

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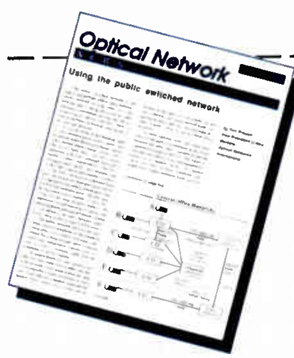

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Last of the good ol' boys

TCI outgoing director of engineering Dave Willis certainly has received a heavy dose of press lately, particularly with what he intends to do with his ears now that he's entered partial retirement—Willis fancies diamond stud earrings, and after *MultiChannel News* reported his intentions to pierce his left ear, Willis received numerous earrings from industry friends and colleagues.

Behind Willis' high profile title, he's best described as a good ol' country boy from Nebraska. He likes to fish, particularly with his four-year-old granddaughter, and hosts a cable fishing tournament every year for "cable people only." He likes to banter with his wife of 34 years, Phyllis, whom he describes as "a good ol' gal." He has an interest in painting—landscapes mostly. "The pictures are no good," Willis laughs, "but it's a relaxing hobby."

And over the next two years, as he phases out at TCI, he'll have plenty of time to do those things. Willis calls the next two years a "perfect transition into full-time retirement." He'll work "a couple days a week" on "anything they give me to do" until 1994.

Nebraska boy

Here's a tip: If ever pulled over in the town of Sidney, Nebraska, just tell them you know Dave Willis. The Willises have upheld law and order in that town for three generations: Dave's grandfather was the fire chief for 25 years, his father was the chief of police for 25 years and his "kid brother" now wears the chief of police badge.

Dave got started in cable in Sidney in the early 1960s, after being discharged from the Air Force and a short stint at Boeing Aircraft Center. "When I got back to Nebraska, I heard the guys were building a cable system. So I went down to see if I could get a job," says Willis.

The rest is history. Willis joined Collier Electric Company (which was later bought by TCI) and spent the first 30 days putting antennas on top of a 750-foot tower. "I got broke-in right," Willis laughs.

In 1969, Willis moved to Denver and became the assistant to TCI's director of engineering. In 1971, he took over the director's post. Willis doesn't hesitate with a reply when asked what happened between 1971 and 1992. "I worked my ass off, and never looked up," he says with a smile. "That's really true. You've got to remember—when I took over as director of engineering, I think we had about 150,000 subscribers. Now, we have somewhere around 12 million. We were in such an expansion mode—that's why I couldn't look up. We were driving so damn hard then."

Willis says his greatest challenge is difficult to pinpoint. Instead, he says, his career has been a series of challenges, the most difficult of which has been the struggle to keep up with ever-changing technology, or, as he puts it, "trying to be current without taking foolish risks in equipment."

"For many years, we had to play it pretty close to the vest. There wasn't a whole lot of investment dollars around. In fact," he says, looking around a conference room in TCI's new building, "somewhere around here you'll find the first major loan to a cable company. It's all framed and everything."

CLI laments

These days, Willis' years of experience and hard work have earned him the right to some forceful opinions—and he has no problems voicing them, either. One of those beliefs concerns CLI.

"There has been a time or two when I've wished our technical community had asked 'why' instead of 'how'," Willis says ruefully. "One of those times was when CLI first came about.

"The way the regulations came out, (the FCC) was trying to control thousands of miles of system and eliminate the radiation from it. The way I see it, it would be much easier to make the CATV carriers unassignable carriers for the FAA, then control the headends.

"If the concern is airline safety," Willis continues, "that is infinitely more safe than trying to control the world of wire. But, I lost that battle. I still don't think I'm wrong, though," he adds, grinning.

Willis is just as frank when discussing his view of cable's future. "I've said this before, and I believe it: The next five years will see as much technical innovation as there has been in the last 10 to 15. I think we're in a super state of flux, and it's not all going to depend on what you *can* do. It's going to depend on what's *economical* to do.

Along those lines, Willis says he's very skeptical about PCN, and isn't sure whether or not movies on demand is a viable business. The latter, he says, depends on the outcome of business tests which will determine whether there is a valid market for VOD-type services.

Willis' philosophy on economic viability plays through to his thoughts on digital compression, as well. He says TCI is pushing both the technological and business aspects of the technology, to see if the two are complementary.

"If the research in (technology and market acceptance) turns out positively, then we'll be very well positioned to go ahead. That's the way to do it: Find out if you have a business, then have the technology ready to take advantage of that business."

Filling the gap

Willis's engineering shoes have been filled by Richard Rexroat, but there's no question that Dave will be sorely missed. Extensive hip surgery (he says his hind end looks like a road map of Wyoming) has curtailed his travel activity over the last few years, and as such Willis has been an extremely accessible source for anyone seeking his assistance.

He says he'll stay involved with the SCTE, though, and will attend the Expo regardless of the travel involved. Willis has been an active SCTE member "forever," as he puts it, and strongly backs the organization.

But mostly, Willis says he'll spend the next two years easing into retirement. He and Phyllis will likely travel domestically, although he says he's already travelled to every state in the Union except one: Maine. And if Willis has as many friends as he does earrings, chances are he'll soon see that state, too. . . .

CED *By Leslie Ellis*

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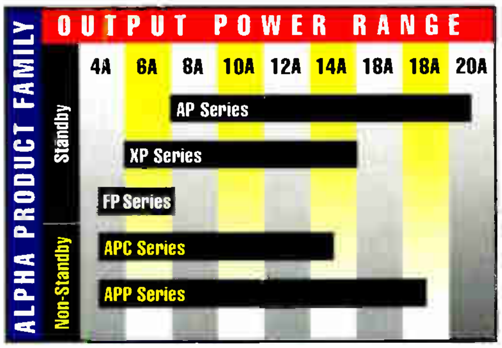

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Interactive TV and the cable information gateway

Television has been a revolutionary medium since its inception. TV has taken hold of the American way of life in ways that its inventors could never have imagined. What started out as a unique means of delivering entertainment has evolved into much more than that. TV is itself continually being recast in new and exciting roles far beyond its basic role of entertaining.

As we close out the century which saw the introduction of TV, there are a plethora of emerging technologies that will revolutionize the way you and I use our television sets. The TV will no longer be simply the ubiquitous, passive glass tube in and around our homes and offices, bringing us laughter, occasionally provoking thought and always providing diversion.

No, in the future, we will have fully integrated entertainment services comprised of such high-tech equipment as high-definition monitors, laser video and CD audio players, interactive information retrieval, interactive VCRs, interactive video games and a functionally expanded cable set-top converter.

What's more, the prevailing wisdom says that we will have 150-plus cable channels to choose from by the end of the decade. Such concepts as movies-on-demand, two-way interactive TV, interactive program guides and enhanced "people meters" are in field tests today, or soon will be.

Universal info distribution needed

Given this technological backdrop, there is a need for a universal information distribution network—one that's capable of providing data, addressability, control, billing, specialized products and access to these new entertainment platforms. The cable industry is uniquely positioned to provide this "information gateway."

A distributed data network concept is being used in the delivery of several cable services today. In fact, some of the services already distributed to the cable industry are the result of more than 10 years of research and development—real-world, marketplace experience that the industry can use to help it take the lead in an interactive environment.

An information gateway should be capable of providing a national clearinghouse for pay-per-view (PPV) order processing and authorization, PPV promotion, messaging, facsimile distribution, digitized image transmission, and more. This central data center would receive all network traffic and process the outgoing data into application-specific information packets for distribution. Each headend file server would have a unique address, and receive only the information packets destined for its service area. Present systems allow multiple levels of addressability, including individual subscriber homes, specific systems, MSOs and regions or DMAs.

We are in an age where many consumers continue to find frustration in merely setting the clocks on their VCRs. So it's clear that the need for simplicity and user-friendliness becomes even *more* crucial, as these new services are introduced. This is even more apparent in the coming era of 150 channels.

With the advent of 150-plus cable channels, there will be an obvious need for an interactive on-screen program guide to help subscribers navigate through the vast maze of program selection. Prevue is currently conducting a field test of its proprietary interactive program guide system, delivered to individual subscribers' homes via the cable information gateway.

The current network infrastructure is comprised of a headend computer file server that processes and delivers program schedule information to subscribers' interactive set-top unit. In any national application, cable customers must have access to similar headend equipment. Application-specific software resides on these distributed headend computer systems. This file server is capable of delivering a wide spectrum of products beyond the interactive program guide.

A national information gateway is the most economical and efficient manner to deliver these new service offerings to subscribers. This network concept provides a convenient way for information providers to have access to a wide audience without incurring large capital start-up costs. Each new information provider would represent an incremental monthly cost to the network for transaction processing. Interactive products including sports, weather, travel, stocks, games and educational services are prime candidates for distribution on the information gateway. Clearly, it is to everyone's advantage to have a standard network model to distribute these new services.

Pro-active stance needed

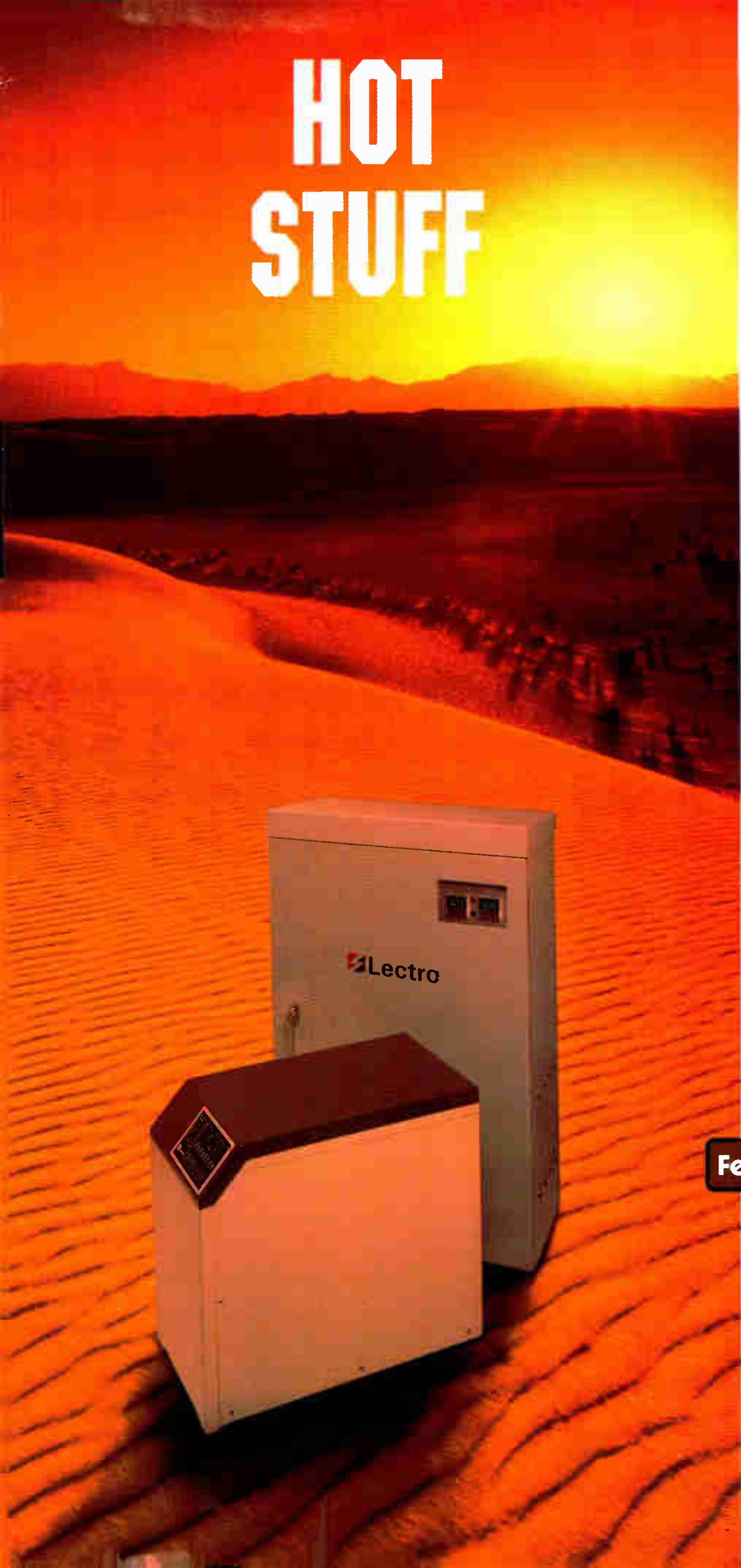
The cable industry needs to be pro-active in positioning itself as the distribution network of choice for the delivery of these services as they become viable products. Fiber optic cable, telephone companies, PCN, DBS and other methodologies are competing for access to the cable subscriber.

Cost-effectiveness is a question we can't afford to ignore as we unveil and roll out all this "gee-whiz" technology—who's going to pay for it, and how much? Proven reliability, plus the economics of satellite point-to-multipoint distribution coupled with cable's ability to deliver products to subscribers will be key components in the marketplace. These elements place the industry in an excellent position to leverage cable's wired network with the information gateway to become the most cost-effective conduit to the home. **CED**

By Jerry Henshaw, Senior Vice President, Science and Technology, Prevue Networks Inc.

Editor's Note: *The opinions expressed here do not necessarily reflect the views of the staff or management of* CED *magazine. Responses from interested parties are encouraged. Responsible persons wishing to express their views on any subject are encouraged to do so.*

Henshaw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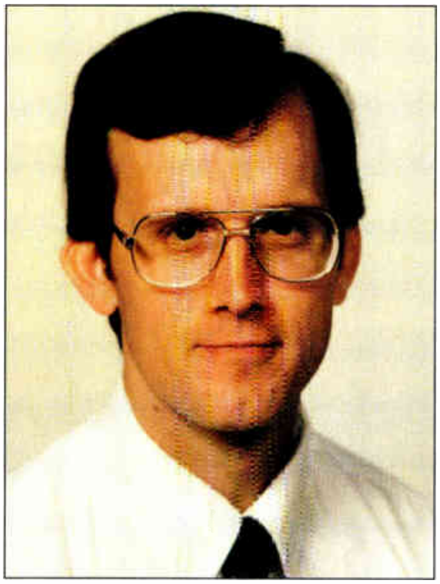


Network considerations for competitive access

Network routing considerations at rebuild time are a seemingly trivial issue when you first think about it. Historically, our plant has been oriented toward bringing entertainment-quality video into the home. As a result, during the original build of the plant, that was probably the *only* consideration given to the routing of the coax.

The issue was how to get from the headend to our customers in the most efficient, cost-effective manner—and oh, by the way, if we could only eliminate all of those major business parks along the way, it would certainly make our lives a heck of a lot easier.

In many cases, after the system was built, potential business customers would come to the local system manager and practically beg for access to the plant for the carriage of local traffic or data. In some cases they would be turned down simply because connection to the plant (after we worked so hard to avoid the business park in the first place) would be too costly and time consuming—not to mention the scarcity of bandwidth.

During the rebuild process today, it's a completely different story. Prior to beginning any rebuild, it's crucial that we consider the potential opportunities for competitive access both within our franchise area, and in cooperation with adjoining MSOs, and route our plant appropriately for access to these opportunities. This must, of course, be a business decision, weighing the potential business opportunities against the cost of re-routing, but it simply *must* be part of the decision process.

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

Target businesses

Businesses to consider as possible candidates include information-intensive businesses such as insurance, banking, and government or administrative headquarters. Obviously, local telephone company central offices (COs) and long distance inter-exchange carrier (AT&T, MCI, etc.) points of presence (POPs) must also be located early in the process, and fiber routes should be plotted for ease of access to these facilities as well. A few strategically placed fiber splice points in close proximity to these facilities may come in handy some day, while not costing us much money up front.

It's crucial that we consider the potential opportunities for competitive access within franchise areas.

Reliability of the network when it is carrying information-intensive data, as opposed to entertainment video programming, becomes a very key issue. Major business customers simply cannot afford to lose data or phone traffic for even very short periods of time. Therefore, the major business customers and the inter-exchange carriers will insist on absolute network reliability, and in some cases will require route redundancy and diversity within the network through the implementation of a ring-type architecture. Automatic routing of traffic and data via a redundant path around the ring in the event of catastrophic failure of the network, becomes crucial.

Status monitoring essential

In addition to automatic traffic routing in the event of failure, many of the major potential customers will require that the initial failure of the network be restored to full service within 24 hours. The implication to us is that status monitoring of the network will be essential. We must be notified immediately of network failure, even though the failure may be transparent to our business customers, in order to ensure that the full ring structure is restored within the specified time frame.

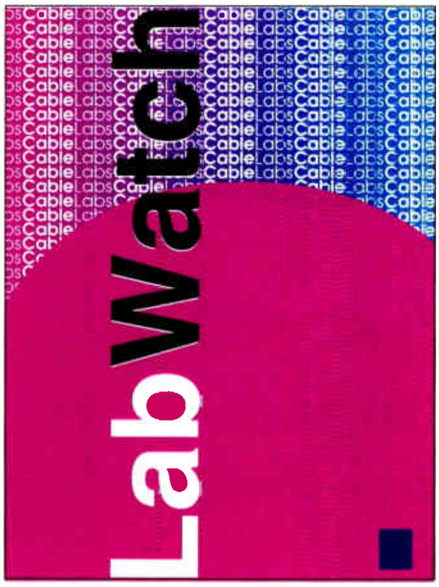
If we take this approach a step further, it would be very easy to envision the need for network performance trend data to be available as opposed to simple alarm data, so that we can anticipate network failure and correct the problem *before* it occurs. (Now, if we could somehow determine how to implement a backhoe proximity alarm, our lives would be complete.)

The number of fibers required within each network will vary from system to system depending upon the nature and amount of competitive access business anticipated (and don't forget the other fiber-gobbling opportunities such as PCN and two-way interactivity that should also be planned for).

And as we deploy this additional fiber, there are several other issues to consider. For example, do we mix all of these services (video entertainment, competitive access, and perhaps future PCN traffic) on a single fiber? Or, as we deploy additional fiber for each of these additional services, do we prefer separate fibers, within a single sheath, dedicated to each new service but readily identifiable via separate color-coded buffer tubes?

This latter approach might help our system maintenance technicians to understand what fibers to attack in the event that maintenance is required. Or, instead of placing data-carrying fibers within the same sheath as those carrying video, do we simply overlash a new fiber bundle at a later date when these future business opportunities actually come to fruition? And what are the legal implications of the above, and how do these implications vary from state to state?

So what's the answer? Unfortunately, each system rebuild is unique, both from a financial and a potential alternative revenue potential standpoint, so an "answer" simply isn't possible. But development of a checklist for discussion of each of these issues at the beginning of the rebuild process, and revisiting each of the issues during design reviews, certainly is feasible, and should be a part of the overall rebuild process. CED



Taking the guesswork out of outages

This article reports on the activities of one of six working groups within the Outage Task Force convened last December by CableLabs—the Outage Detection and Tracking working group.

The overall task force, chaired by Bradley Johnston of Warner Cable, divided the outage problem into six component parts. Michael Miller, director of customer service at Viacom Cable, chairs the working group on detection and tracking.

The subgroup chaired by Miller broadened its focus somewhat by setting these tasks:

• Surveying customers' attitudes toward outages;

• Writing a precise, usable definition of an outage;

• Developing a methodology for detecting and tracking outages, one that would support both restoring outages that occur and taking systematic steps to decrease their frequency.

Joining Miller in the outage definition phase of the project were Bill Spies and Dave Seibold, both of Warner Cable. In the detection and tracking phase, those three were joined by Cyndee Everman of Warner and Scott Bachman of CableLabs.

The best previous data on customers' perceptions of outages had come from a 1990 Viacom survey which revealed that customers who experience two or more outages during any three-month period are twice as likely to downgrade their cable service. But in a 1990 survey conducted by OnTRAQ of Pittsburgh, Pa., and reported to CableLabs by Westinghouse's Optimized Systems Operations Research, customers said they had experienced, on average, 5.6 outages per month. Clearly, the industry has a problem.

By the CableLabs Staff

But just how big of a problem?

Working with CableLabs, Miller seeded the 1991 Viacom annual customer survey with questions about perceptions of outages, developed in conjunction with CableLabs. The survey was conducted during August-September 1991 again by OnTRAQ. Miller presented the findings at an outage reduction task force meeting in Boulder in December.

Survey subjects were asked how their attitude toward cable service was affected—not just by outages in general, but by outages of varying durations and by outages that affect varying numbers of channels.

Their responses are summarized in Table 1. In a nutshell, subscribers said that outages of less than a minute are fairly tolerable, but their frustration level rises steeply if the outage lasts 10 minutes. Frustration rises further, but at a slower rate, if the outage lasts an hour. Frustration rises even more slowly between a one-hour outage and one lasting 24 hours.

The survey also revealed there is little difference between the customer's negative reaction to a single-channel outage and an "all channels out" outage.

Miller commented, "We were surprised that single-channel outages had as much impact as all channels out, and we were also surprised at the quickness with which customer irritation escalates. We thought we had a wider window."

And, he noted, while responding to an outage and fixing it within one hour might seem like a major logistical feat to someone inside a cable system, to a customer, it's not good enough.

What is an outage?

The process of defining what constitutes an outage is no mere academic exercise—it sets the direction for a long list of steps to follow. This is the definition the group derived:

"Loss of signal on one or more channels to two or more customers arising from a common cause."

Three clarifications were added:

1. "An outage is defined as a situation in which the customer experiences loss of signal, regardless of the cause."

2. "Loss is defined as an interruption rather than degradation of signal. The picture must be so degraded as to be essentially unwatchable."

3. "Loss of a single channel at the headend or a hub site is included."

The most important thing about this definition is that it is customer-centered, Miller said. This, he added, is an appropriate approach for two reasons:

First, by defining outages from the customer's point of view, "We can no longer discount outages that we've caused." In other words, he said, an outage is an outage.

Second, cable networks lack the elaborate remote sensing equipment found in other industries. Developing cost-effective solutions for today's one-way architectures was one of the Outage Reduction Task Force's major objectives. By having customer phone calls trigger outage alerts, a system can be built for a fraction of what a system based on remote sensors would cost.

However, as the industry adopts increased use of fiber architectures and carries data communications services on the same fiber/coaxial hybrid networks, remote sensing equipment, in combination with customer-activated trouble calls, should make the detection systems even more effective.

Such a definition, Miller noted, goes against many engineers' tendency to see outages in terms of some index of system reliability generated by an electronic measuring system. The new definition "has raised some eyebrows," Miller said. "But once we're able to talk to people about it, they see the rationale for it."

Detection and tracking guidelines

Armed with a precise definition of an outage, the group was able to start writing ground rules for detection and tracking. In a six-page document entitled "Outage Detection and Tracking Guidelines," the working group laid out for vendors its consensus position of how such a system should work.

The group proposes to rely on a software enhancement to existing cable billing systems. Input to the enhanced billing system comes from:

• Customer service representatives (CSRs) writing outage reports and work orders much as they do now.

Table 1
Subscribers' response to outages

Question: "How upset are you if reception is lost for:"

	ALL CHANNELS OUT	delta	CHANNEL WATCHED OUT	delta
About one minute	3.81		3.80	0.01
		0.92		
About 10 minutes	2.89		3.04	-0.15
		0.77		
About one hour	2.12		2.23	-0.11
		0.46		
All day	1.66			
Average through one hour	**2.94**		**3.02**	**-0.08**

(Scale: 5 = not at all upset; 1 = very upset)

• Automatic response units (ARUs), which are increasingly being used to field calls when the CSRs are flooded with calls or otherwise unavailable.

• Remote sensing equipment if currently used by cable operators.

With an ARU, the caller generally reports an outage by tapping a requested key on the phone keypad; the ARU also asks callers to input their phone numbers. This can be referenced against the billing database to determine the caller's address, and the ARU can even be configured to call the customer back when the outage has ended.

Such an approach pre-empts the role of CSRs and technicians in deciding—often too subjectively—what constitutes an outage and when the outage starts. Automated systems should excel in identifying and reacting to small outages, Miller said.

Detection. The document asks that the user be able to define exactly what chain of events triggers an outage alert—including such variables as the triggering event (a service call, no-truck-roll service call, a call through an ARU), the area designator (such as amp number or ZIP+four code), the type of outage, etc.

The system must also permit the user to trigger or cancel alerts manually.

It also must have user-controllable capability for "logic tree" analysis, to perform such specialized tasks as:

• Detecting, through inferrence, otherwise undetectable outages;

• Identifying the technician who is in the right place, with the right equipment, to respond to it;

• Printing out a map showing the best route from the technician's current location to the outage site.

Tracking. To facilitate detailed tracking and reporting, the document suggests what data elements should be stored and for how long.

It also asks that the data be "projectable to a mapping system" so outages can be better pinpointed. The task force also gave vendors sample formats for reports they would like the new systems to generate.

"These reports will give managers an overview of what has caused the outages, how they were fixed, where they're occurring, how many customers are affected, and whether or not the fixes that we're putting in place are really working," said Miller.

Through this combination of decision-making software and accurate record-keeping, said Miller, cable systems will for the first time have reliable data with which to assess outage performance of individual systems and compare the performance of different systems in their company.

Under "General Considerations," the document asked that solutions provided be: easy-to-use, linkable to PCs, well documented and affordable, even for small systems.

The vendors react

As part of the December gathering in Boulder, the detection and tracking working group met for a day with respresentatives of 10 companies that market billing systems, ARUs or CAD/CAM-type software packages.

The companies represented were: CableData (U.S. Computer Services), Dialogic Communications Corp., Cable Services Group (a subsidiary of First Data Corp.), Information Systems Development Inc. (ISD), The GeoSystems unit of R.R. Donnelley & Sons Co., EDC Cable Television Services, Telecorp Systems Inc., Ubiquinet Inc. and SecaGraphics International Inc.

The vendors' response?

"Most of them indicated that not only was what we were requesting for the most part doable, but some of the vendors had already accomplished much of what we had asked for," Miller said.

Most vendors felt the upgrades "were achievable with existing resources, without the development of new methodology," Miller noted. He added: "I expect all the major vendors will hop on this and go with it. They know we're serious and that we're voicing our common concern."

Miller said his task force isn't specifying how the vendors meet these objectives. Some of the product breakthroughs, he said, will probably come from collaborative efforts between vendors.

And, he added, he expects to see the outage tracking and reporting capability incorporated into the products of at least some of the vendors by the end of 1992.

The upshot, Miller said, is twofold: "Faster identification of outages and response to them, plus better reporting tools to help steer the preventive effort."

The ultimate payoff? "Better perceived value of cable, more customer loyalty, and increased retention." **CED**

Extending the advantages of fiber optics

Fiber optic technology has developed over the years to a point where no one now questions the validity, or the cost, of full optical deployment. Instead, the focus of late has centered around methods of driving fiber deeper into the plant, thereby enabling cable operators to eventually offer more than traditional entertainment services.

Digital compression, near video-on-demand (NVOD), personal communications networks (PCN) and high-definition television (HDTV) are all applications driving the demand for newer, bolder networks that lay the foundation for provision of such services. In today's industry, it appears as though fiber nodes serving 500-home "pockets" may be the optimal size required to provide these applications. Yet, the fiber-to-the-feeder (FTF) architecture often deployed provides service to fiber nodes feeding between 2,500 and 2,700 homes. For the interactive capabilities required by these new services, serving areas will need to be substantially reduced.

With this in mind, a new architecture, the Star-Star-Bus 500 (SSB-500) has been designed to cost effectively position the cable operator to design cable plant today that will support many new business opportunities in the future.

Following is a brief look at design considerations for both the FTF and SSB architectures. Equipment needs, performance specifications, and cost comparisons are also examined.

By Mike Sparkman, Vice President Sales and Marketing, Optical Networks International, and Dale Lutz, President, Engineering Technologies Group Inc.

Designing the FTF

When first introduced in 1990, ATC's FTF architecture was a dramatically different approach to combining AM fiber optic technology with RF coaxial components. Whereas the fiber backbone reduced the number of amplifiers in cascade, the FTF architecture eliminated trunk amplifiers entirely.

With the FTF design, fiber optic cable and an AM laser transmitter and receivers are used to extend fiber's reach deeper into the system. The fiber cable leaves the headend in bundles which decrease in size as each optical receiver is reached. Once at the receiver, or node, the signal is converted from light to RF and transmitted via the RF portion of the plant. Optimally, no more than four amplifiers are fed from each node.

Benefits obtained from using the FTF architecture include: elimination of the trunk portion of the plant, specifically the coaxial trunk cables, amplifiers and passives; reduction of the number of active devices between the subscriber and headend; and a cost parity with conventional tree and branch newbuilds.

One of the largest benefits derived from deploying the FTF design is its ability to push fiber deeper into the plant. This not only results in better picture quality, ease of maintenance and improved reliability, it also simplifies bandwidth expansion for the

Comparative Bill of Materials

Fiber to Feeder

OPTIC PLANT	Quantity	Qty/Mile
Fiber optics:		
DFB Transmitters	6	0.06
Multi Output Receivers	7	0.07
Optic Splits:		
50/50	1	0.01
Fiber Cable	Feet	Ft/plant mile
6	19,476	205.16
12	6,405	67.47
24	9,034	95.16
30	9,570	100.81
36	41,865	441.01
RF PLANT		
Actives:		
AGC PHD Sys/Amp	87	0.92
Thermal PHD Sys/Amp	59	0.62
Single out PHD/Line Ext.	390	4.11
Forward Pads	536	5.65
Forward Equalizers	536	5.65
Reverse Pads	536	5.65
Reverse Equalizers	536	5.65
Cables:	Feet	Ft/plant mile
QR860 Express	111,833	1,178.06
QR540 Feeder	505,045	5,320.18
Power Supplies:		
6A Standby Power	0	0.00
9A Standby Power	0	0.00
12A Standby Power	0	0.00
15A Standby Power	39	0.41
Optic plant total per subscriber:*	$16.84	
RF plant total per subscriber:**	$38.05	
Total cost per subscriber:	$54.89	

Star-Star-Bus 500

OPTIC PLANT	Quantity	Qty/Mile
Fiber optics:		
YAG Transmitter	33.00%	0.00
YAG Receiver	2	0.02
DFB Transmitter	6	0.07
Multi Output Receivers	30	0.33
Optic Splits:		
50/50	13	0.14
30/30/30	2	0.02
Fiber Cable	Feet	Ft/plant mile
8	96,116	1,052.98
12	5,626	61.63
24	6,788	74.36
28	554	6.07
32	3,076	33.70
RF PLANT		
Actives:		
AGC/PHD Dist. Amp	235	2.57
PHD Line Extender	223	2.44
Forward Pads	458	5.02
Forward Equalizers	458	5.02
Reverse Pads	458	5.02
Reverse Equalizers	458	5.02
Cables:	Feet	Ft/plant mile
QR860 Express	155,440	1,702.89
QR540 Feeder	485,968	5,323.93
Power Supplies:		
6A Non-standby Power	3	0.03
9A Non-standby Power	10	0.11
12A Non-standby Power	20	0.22
15A Non-standby Power	18	0.20
Optic plant total per subscriber:*	$19.75	
RF plant total per subscriber:**	$34.91	
Total cost per subscriber:	$54.66	

*Optic totals include splices and enclosures.
**RF totals include external passives, internal passives, directional taps and connectors

Figure 1

future. At the time the FTF design was introduced, it was believed the architecture adequately positioned a cable system for future services such as switched video for NVOD and two-way services.

However, with the interest in digital video compression and the subsequent opportunities it makes available, the 2,500-home pockets fed from any FTF design should be downsized

> SSB was developed to design cost-effective plant serving no more than 500 homes per node.

in order to take advantage of future business scenarios.

New design approach

The SSB-500 is a next step in the architecture evolutionary process. It was developed in an effort to design cost-effective plant serving no more than 500 homes per node. The SSB-500 will not only position a cable system for future services, it also provides:

- better reliability,
- simplified powering, and
- a reduction of RF electronics in the distribution plant.

The SSB-500 is most effective when utilized during a full rebuild or with an upgrade where cable reclamation is the only limitation. The architecture demands a different approach to system design, beginning with a detailed analysis of dividing cable plant into 500-home pockets. While most cable systems are designed from the headend to the subscriber's home, the SSB-500 is designed from the 500-home serving area back to the headend.

In order to effectively compare cost and design considerations between the FTF and SSB, a cost analysis was undertaken for both architectures. For this economic model, both architectures were used to design the same 95 miles of cable plant, passing 15,500 homes. Results of this comparison are the basis for all tables and figures used in this article.

Because the SSB necessitates a new approach to system design, the first step is to evaluate the cable plant and divide it according to 500-home pockets. In actuality, the homes passed in each section may range from 400 to 550 homes, depending on the geographical area covered and the topology of the plant. (See Table 1.)

An important consideration when determining how to break up geographical areas is to envision future services and plan pocket areas according to those expectations. For example, subscriber demographics may lead to grouping areas of common interest such as a specific group of residential homes in one pocket, a commercial segment in another, and a multi-dwelling unit (MDU) complex into a separate pocket. This will allow an operator to position specific equipment according to anticipated revenues from each pocket.

Because the optical bridger can coexist with a PCN transceiver in the SSB-500 design, it is important to take into

Performance Specifications At Operational Levels

FTF	DFB/Link	Optical Bridger	PHD Dist./Amp.	PHD/LE	Combined
CNR(dB)	51	64.2	62.0	59.0	49.9
CTB(dBc)	65	70.0	61.8	62.8	53.4

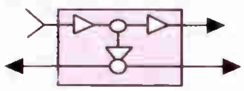
SSB	YAG Link	DFB Link	Optical Bridger	PHD	PHD	Combined
CNR(dB)	54	51	65.5	62.0	65.2	48.8
CTB(dBc)	65	65	64.0	70.0	71.0	54.7

Notes: Optic links combined @ 15 log
RF links combined @ 20 log
Optic plus RF links combined @ 20 log

Operational Levels

	FTF	SSB
Optic Bridger Output	4 @+43 dBmV	1 @+46 dBmV -or- 4 @+46 dBmV
RF Active Outputs		
AGC system amp	2 @+43 dBmV (See 1 below)	N/A
AGC Line Extender	N/A	1 @+46 dBmV * (See 2 below)
Thermal line extender	2 @+43 dBmV	1 @+43 dBmV

*AGC distribution amp derated to +43 for cascades of two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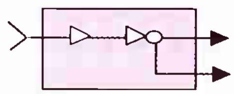
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Table 3

OTN's placement in the plant can have strategic implications, contingent on future needs and desires.

For example, by linking the OTNs via fiber optics, a possible scenario may be to build a "ring" architecture within the parameters of the cable plant. This ring configuration is predominantly known for its excellent reliability and will provide a technical platform for business opportunities in alternate access and PCS.

Positioning plant now

As this article demonstrates, the SSB-500 allows a cable operator to position the cable plant for future opportunities. It is also a cost-effective method of designing systems today for increasingly sophisticated entertainment services. Because revenues are application driven, it is necessary to provide the correct technical platform to support applications. While existing architectures can be modified or upgraded to provide for smaller serving areas and efficient transmission, the SSB-500 provides immediate positioning for existing businesses, as well as tomorrow's opportunities. **CED**

Photonics for cable television system design

Migrating to regional hubs and passive networks

Today's cable network is migrating from the traditional tree-and-branch topology that was originally designed for point-to-multipoint video entertainment to a distributed star, tree-and-branch topology. The new architecture has a robust, dynamic capability for a wide range of applications beyond video entertainment. While the telephone companies face a mass deployment of switching and fiber optic technology in order to gain the bandwidth to enable them to deliver video entertainment, cable is in the position of capitalizing on its strategic investment and rapid prototype capability on a much quicker time line.

With the advancements in fiber optic technology, two separate migrations are achievable in the near future: one toward a regional hub concept and the other toward largely a passive network. The need to provide a more uniform service offering for large and small cable operators, share functionality, minimize operating costs and improve signal quality and reliability is motivating the cable industry toward these two advances in network architecture and design.

This network architecture and design is derived from the collective development of many cable network designs and is intended to provide a path for graceful migration without obsoleting existing investments.

Existing designs

Typical cable television systems are evolving from an all-coaxial cable design to a hybrid fiber and coaxial network design. Both designs are analog.

In cable television systems, signals are collected from the program sources at a "central headend" and are distributed from there to the home.

Coaxial-based systems. Coaxial-based systems are common throughout the United States and Canada. Signals are collected from the program sources at the central headend and distributed from there to the home on coaxial cable. At the central headend, program and other signals are assembled in frequency division multiplex (FDM), i.e., each signal occupies a distinct frequency band.

"Trunk" cables carry the assembled FDM signal from the headend toward locations distributed in the franchise area, where "local distribution" cables extend down the streets and behind homes. "Drop" cables connect from the local distribution cables to the subscribers' homes.

In order to overcome losses, amplifiers are placed at convenient points along the trunk and local distribution cables. These amplifiers are typically powered by 60-volt, 60-Hz AC that is im-

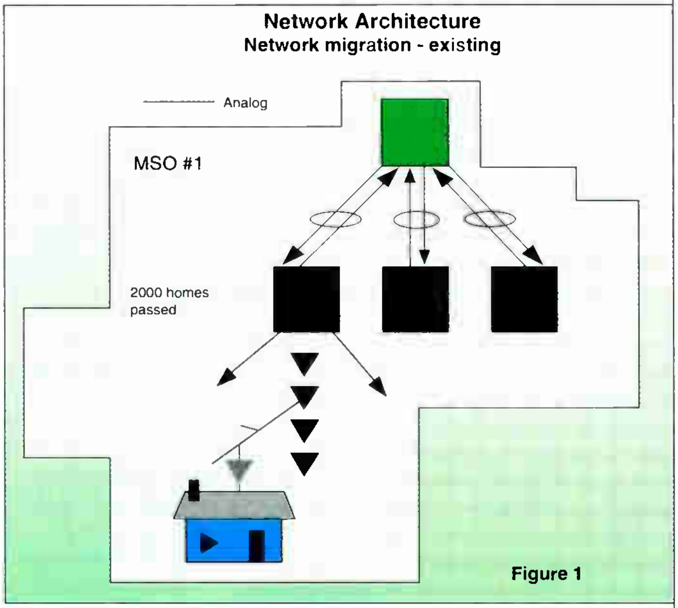

Figure 1

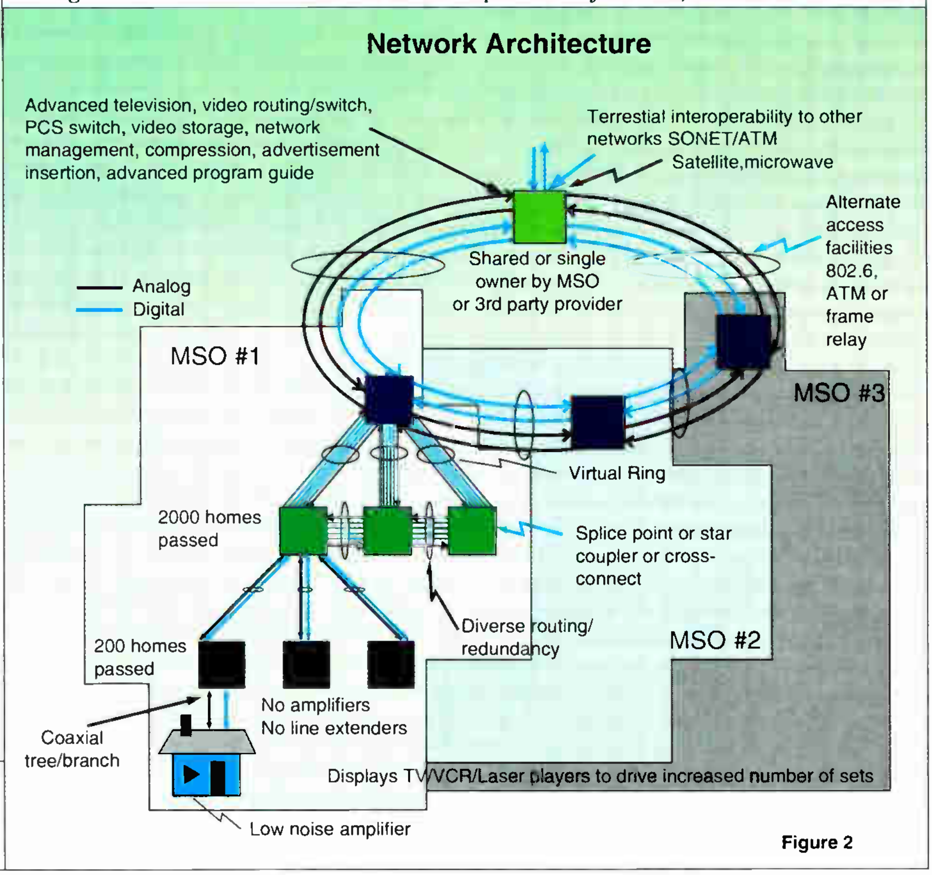

Figure 2

By Stephen D. Dukes, Director of Advanced Network Development, Cable Television Laboratories Inc.

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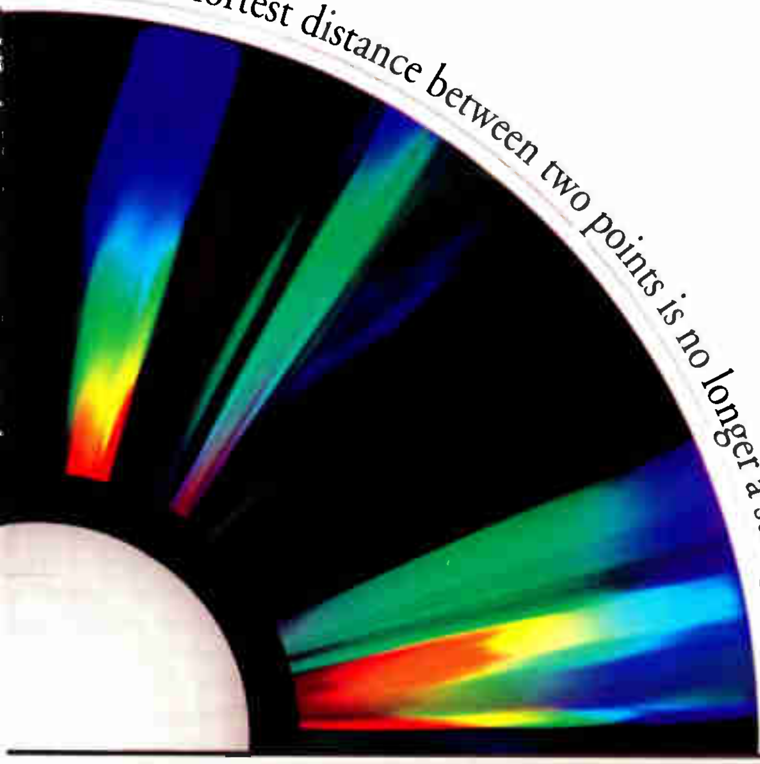

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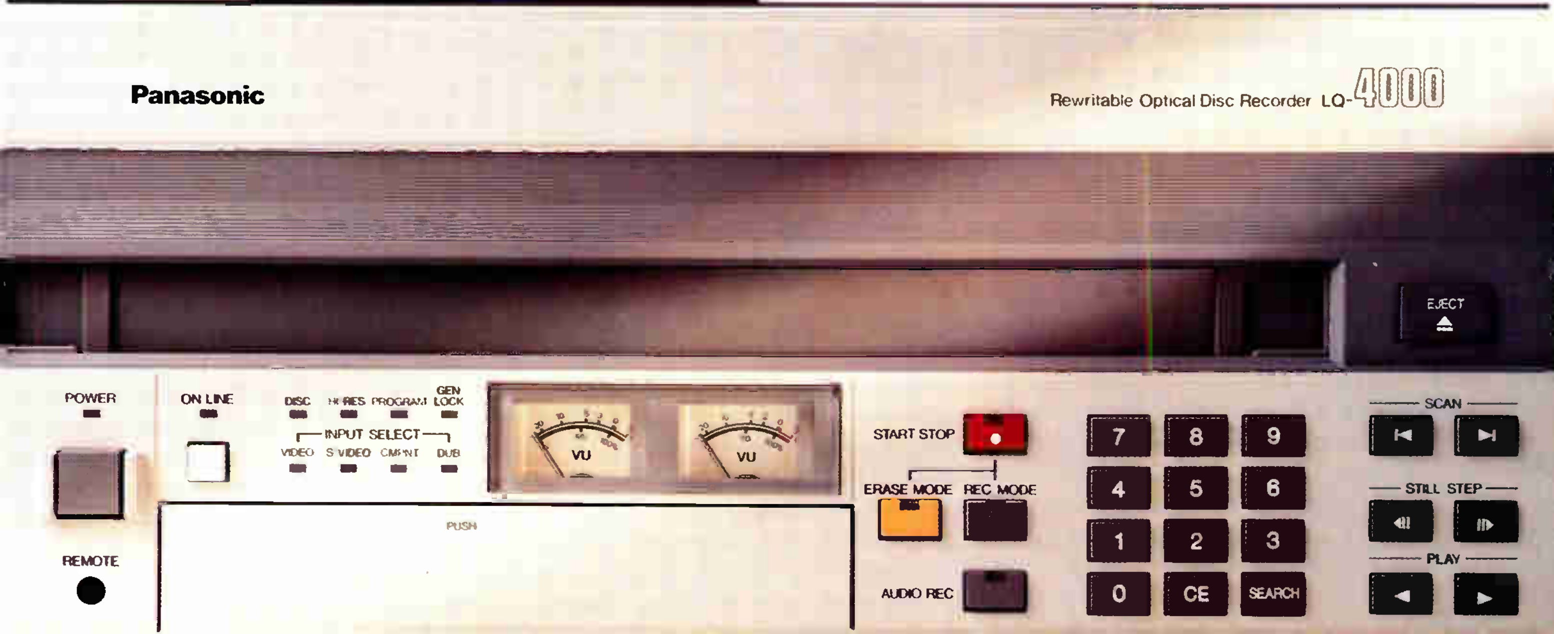

pressed on the coaxial cable center conductor.

The typical passband of an all-coaxial system in the "downstream" direction, i.e., to the subscribers, is 50 MHz to 350 MHz, 450 MHz, 550 MHz or higher. Most modern systems are capable of being upgraded to add an "upstream" passband, typically 5 MHz to 30 MHz or 33 MHz, but the upgrades are only equipped where there is a defined upstream need, e.g., to carry programs from a local source to the headend.

Hybrid fiber and coaxial systems. Hybrid fiber and coax systems are now frequently being provided when coaxial-based systems are upgraded, and are typical of new construction.

In the hybrid fiber and coax system, fiber cables are provided from the central headend to "fiber hubs" that are centrally located among about 2,000 homes passed. From this location, coax local distribution and drop cables extend to the homes. Figure 1 illustrates the hybrid fiber and coaxial cable system.

Fourteen percent of typical hybrid fiber and coaxial network consists of trunk, with local distribution accounting for 36 percent of the network, and 50 percent of the network deployed in the drop. The trunk is fiber optic cable, and the remainder of the infrastructure is coaxial, with no more than four amplifiers and two line extenders in cascade to the home, as in the coaxial-based case.

Fiber is being introduced because it enables a substantial improvement in system performance and reliability by significantly reducing the quantity of active components. This is realized in terms of greatly increased downstream

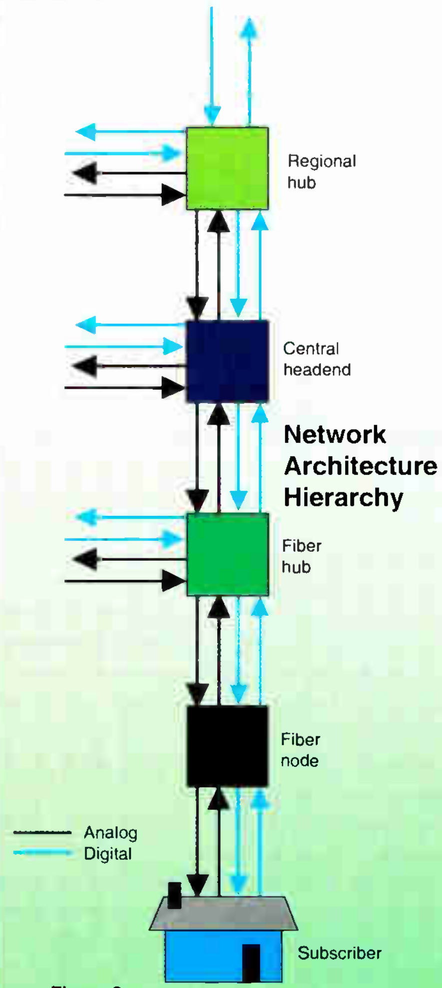

Figure 3

passband capability (a case in point is Time Warner's 1-GHz system constructed in Queens, New York), which permits additional channels for services such as multichannel pay-per-view, and greatly improved carrier-to-noise ratio (CNR), which result in improved picture quality for the subscribers. The additional capacity also lends itself to the provision of other services, such as alternative transport, personal communication services (PCS) and multimedia.

Multiple headends. In any given region, it is likely that there will be more than one cable operator with one or more central headends serving a portion of a geographical area. Service is provided independent of other operators, even though the cable operators may obtain some or most of their source material from the same programming providers.

Hence, duplicate satellite feeds, off-the-air equipment, and microwave facilities are required to secure this source. This plant might be shared across several central headends in the same region owned by the same cable operator, however, usually not with other adjacent or separate cable operators in the region. This is further complicated by the fact that most operators provide functionality that is duplicate of other cable operators for video storage, advertisement insertion and other functionality. This leads to slow implementation of new service opportunities.

The need to provide increased functionality, improve system performance and reliability, reduce operating costs, reduce the interval for introducing new services, spread capital investments across a wider base, develop interoperability with other networks, provide a more uniform service offering across the cable industry, and offer a platform for the deployment of new technologies are some of the motivations behind the development of a structure network architecture.

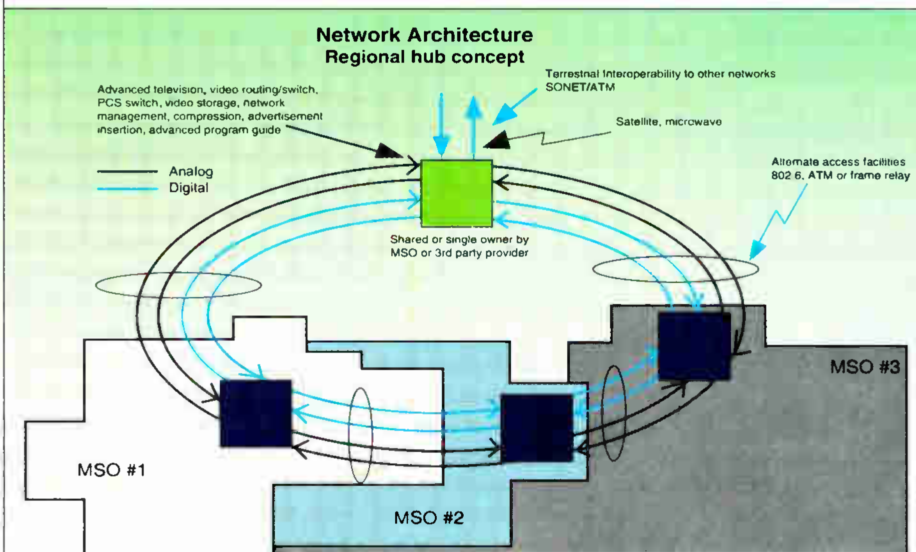

Figure 4

Structured network architecture

The new network architecture, which is under study by Cable Television Laboratories Inc. (CableLabs), provides a fundamental set of rules for migrating these capabilities into the fabric of a new structured network infrastructure. Figure 2 illustrates the block diagram of the network architecture.

This architecture was conceived to take into consideration a wide variety of networks so that no operator's network is obsoleted and will allow for incremental migration rather than requiring cable operators to rebuild their networks.

The migration to the regional hub and fiber node concepts adds two levels of hierarchy to the existing architecture. Figure 3 illustrates an architec-

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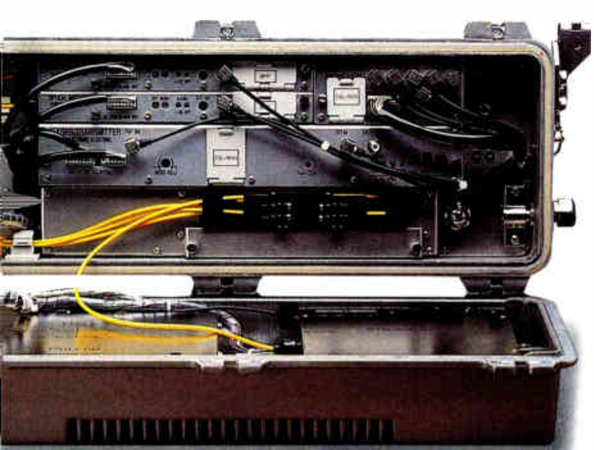

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tural hierarchy, from a top-down view. The regional hub and the fiber node represent the new additions to a modern cable architecture.

Regional hub

Benefits of the regional hub concept. The need for a regional hub is derived from the requirement to centralize capital-intensive investments for a range of advanced functionalities, and to share the investment across a wider base.

With the advance of technology, the need to offer a more uniform service platform is necessary in order to minimize the disparity between large and small operators. The costs associated with the introduction of new technologies such as advanced television (ATV) may preclude some smaller cable operators from offering this capability.

The regional hub will provide a means for all cable operators, large and small, to provide a similar, uniform set of ATV features and functionality.

The migration of cable systems to 1 GHz and the introduction of multichannel pay-per-view also suggest the need for mass storage video sources from a centralized, shared facility. Other functionalities, such as advertisement insertion and digital video compression, may follow the same trend toward centralization. PCS and multimedia applications are likely to involve significant investments which in the early stages are better made higher in the network hierarchy at a centralized facility and shared across a larger base. As the demand for these applications and functionalities increases, it may become appropriate to migrate various functionalities, such as video storage, closer to the subscriber.

> In the initial stages of the introduction of digital video compression, digital decompression facilities can be located at the regional hub.

Functions of the regional hub. The regional hub is a centralized shared facility that serves many functions. For example, it can serve as the platform for:

- Advanced television,
- Bulk program distribution,
- Storage facilities for network-distributed video on a regional basis,
- Mass storage for multichannel pay-per-view,
- Advertisement insertion facilities,
- Compression/decompression of video source,
- Advanced program guide for multichannel systems,
- PCS switching and cross-connecting facilities,
- Multimedia distribution, and
- Automated network management capabilities.

The regional hub allows multiple cable operators to share the additional revenue streams as well as the investments and risks associated with providing the advanced applications. The regional hub could be owned by a CableLabs subsidiary, a predominant cable operator or a third party.

The regional hub provides cable operators with a centralized platform for performing rapid prototyping on new advanced applications. As these applications are "proven in" and the demand grows, they can be gracefully migrated down from the regional hub to the central headend and from the central headend to the fiber hub or node.

The regional hub provides an access point to other networks including:

- local exchange carriers,
- inter-exchange carriers,
- alternate access carriers,
- satellites,
- microwave,
- cellular,
- off-the-air broadcast,
- PCS providers.

In the initial stages of the introduction of digital video compression, digital decompression facilities can be located at the regional hub. This will reduce the need for decompression at the headends. Furthermore, by providing decompression at the regional hub, the decompression will occur close to the digital advertisement insertion, however, the implementation and segmentation of advertisement insertion directed toward specific market segments remains a technological challenge.

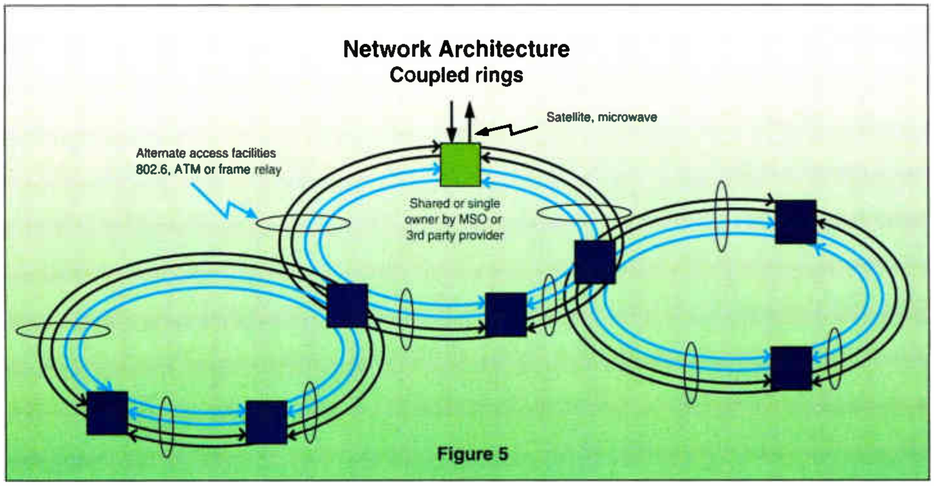

Figure 5

The regional hub will serve as an access point to digital transmission networks, including synchronous optical network (SONET). This keeps the interconnection point at a higher hierarchical level and allows the cable industry to provide proprietary protocols within the cable infrastructure if it so chooses.

The transport of video entertainment to the regional hub initially will be analog and digital between the regional hub and central headends and may eventually provide consolidation of satellite dishes to improve the signal quality and the leverage of the collective cable operators.

Once again, as the demand increases, the migration may imply some form of complexity in the network at points, such as at the fiber hub or fiber node. This complexity would likely be some form of multiplexing and demultiplexing capability. Such a system may have functionality like asynchronous transfer mode (ATM) which could potentially be deployed at the subscriber's home.

The shared regional hub provides cable operators with the ability to negotiate programming arrangements in bulk and thus reduce the cost of programming for large and small operators. This is particularly important as a means of minimizing operating costs.

Regional hub implementation

Figure 4 depicts an example of the physical implementation of the concept. It should be noted that the actual implementation and migration may differ among the cable operators, with each cable operator supporting a specific application that is shared across the regional serving area.

One example is a cable operator providing transport to a cellular radio operator who provides the switching functionality for several cable operators.

Another example is a dominant cable operator offering multichannel pay-per-view, who provides the video storage to other cable operators connected to the regional hub.

A third example is advertisement insertion offered by one cable operator to other cable operators connected to the regional hub. These functionalities could be offered even though the equipment resides in different geographic areas within the regional structure. As this concept becomes more mature, it is likely that many of these applications will be centralized to the regional hub.

Hub interconnections

An integral part of the network architecture is the need to interconnect the regional hub with other networks for real time programming source and control access.

The regional hub provides an interface to other networks and to the central headends in that region. The interconnection of the regional hub to the central headends may be through a ring topology.

The ring consists of broadband, "self-healing," dual-alternating, analog and/or digital fiber facilities. The ring consists of fiber cable where the sheaths contain either all digital, all analog, or digital- and analog-based fibers. Radio may be used where fiber is uneconomical or inexpedient.

Two field projects are being planned which will serve as the platform for a series of tests.

The ring is the topology of choice because of its favorable economics and high reliability, and to ensure diverse routing. The ring topology allows for interconnecting large and small cable operators to a wide variety of advanced applications over a regional area (e.g., an entire metropolitan area). For example, the ring topology places cable in a good position for transporting both PCS and cellular radio.

The ring will use the most appropriate broadband protocol suite and we now are assessing various protocols. Protocols that show promise include the IEEE 802.6, known as distributed queue dual bus (DQDB), asynchronous transfer mode (ATM), frame relay, IBM Paris, Fiber Distributed Data Interface (FDDI), and Switched Multimegabit Data Service (SMDS) (Bellcore's version of 802.6.)

While these protocols may or may not be compatible, it is possible to use attributes from each protocol to facilitate the most efficient delivery of video entertainment and other information services from the regional hub to the home, either from an end-to-end basis or within the ring itself. Minimizing cost and complexity will be a primary motivation in the selection of an appropriate protocol.

For television, conventional ATM cells may be too small and include too much overhead to be efficient within the ring, so larger cells may need to be defined. Furthermore, ATM discards lost packets. If a particular ATM packet is critical, such as in digital video compression, this may result in the loss or degradation of the picture at the subscriber's display.

On the other hand, the loss of frames should be negligible in a fiber-based system. ATM may be a good transport mechanism in the ring and on the fiber portion of the cable distribution plant, but using it all the way to the home requires further analysis. Also, frame relay may prove to be more practical than ATM or other previously mentioned protocols.

The ring can provide coverage for wide geographic areas either independently or through coupling of rings subtended off the primary ring. This coverage allows for interconnection of many central headends in a regional area. The ring can support a physical area within a 200-mile radius. With coupled rings, coverage of a larger geographical area may be achievable. Figure 5 illustrates the use of tightly coupled rings to extend the service area of the regional hub.

Many of the ring transport facilities already exist and can be leased through an alternate access provider or metropolitan area network (MAN) provider. Alternatively, they can be owned by a cable operator. The ring may be provided by other transport providers, such as a telephone company, an interexchange carrier or other long-haul carriers.

In some regions, a cable operator may have many central headends, while in other regions, different cable operators provide service in areas which are adjacent to one another and each has a central headend. Typically, each central headend is a standalone system with a great deal of redundant functionality within a regional area.

Regional hub field test

Two field projects are being planned which will serve as the platform for a series of tests. Both tests will derive functionality in a distributed fashion from participating cable operators to minimize expense and take advantage of capabilities already in place. The regional hub function will be assumed by one cable operator that has significant presence and transport infrastructure in place. Other cable operators in the area will contribute functionality to the regional network concept.

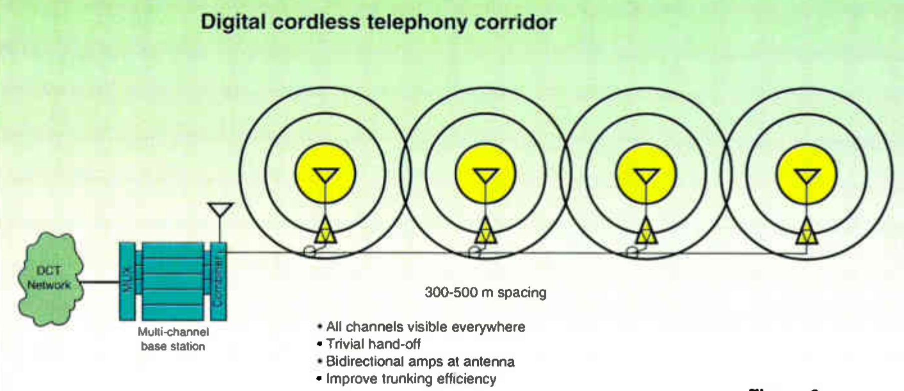

Figure 6

An integral part of these tests is the shared business arrangements. Typically, each cable operator is a closed network; however, through this configuration, each participating cable operator will be sharing the risks, costs and benefits of the regional hub concept. This will provide an equitable arrangement that will encourage large and small operators to participate.

Regional hub migration

The migration to this network architecture is graceful in that it provides a path to the future without making obsolete any existing network design. For example, cable operator 1 may choose to migrate the fiber node concept over time. Cable operator 2 may choose to migrate to 500 homes passed now; while cable operator 3 may migrate to the fiber hub and go no further. Obviously, the more closely one follows the migration path to the network architecture, the greater the functionality that can be achieved.

The initial implementation of the ring is likely to be some form of multiplexing back-to-back at each of the central headends subtended from the regional hub. Functionality will likely be provided in early implementation through the sharing of resources already deployed in one or more locations, i.e., one central headend may provide advanced television signals to multiple central headends through the ring topology, while another headend may offer advertisement insertion to the same group of central headends owned either solely or through several cable operators. As the regional hub concept evolves, a single location will be identified as the regional hub with the collective functionality centralized for efficient utilization and operation.

Fiber nodes

In general, the cable network design has attempted to maintain network complexity at the headend and the home. However, with the introduction of applications such as PCS and multimedia, this network architecture may require distributed intelligence in the network as demand increases and the cost of intelligence decreases.

As envisioned, the central headend/fiber hub/fiber node scenario incorporates a typical cable network architecture of fiber between the central headend, the fiber hub, and the fiber node and coax from the fiber node to the home. The connections between the central headend and the fiber hubs, and the hub to hub interconnections, provide "virtual" ring capability and true physical routing diversity.

A deployment of fiber paths between hubs is being considered that will provide a virtual ring as well as diverse routing capabilities, along with redundancy and reliability. The ring can support large distances, as illustrated by Rogers Cablesystems in Canada. The Rogers configuration includes a central headend with primary and secondary hubs, all connected by fiber rings. The notion of primary and secondary hubs is essentially synonymous with the definition of fiber hubs and nodes described in this paper, with a few a distinctions which will not be addressed here.

A cross-connect system will be deployed at fiber hubs to facilitate the virtual ring. It may be analog or digital, depending on the need for reliability, redundancy, reconfiguration and restoration. A star coupler may be deployed at the fiber hub to allow for diverse routing. Eventually, some form of switching or routing intelligence may be deployed at the fiber hub or fiber node, although the fiber nodes are the likely locations.

The basis for deploying remote switching in a telephone network is to facilitate much of the traffic for voice and data applications. This concept applies equally to the fiber hub. For this reason, some form of intelligence may be required at some point so that traffic destined for an adjacent fiber hub or node does not transit back to the regional hub or the central headend.

The fiber node assists cable operators in efforts to improve system performance, reliability flexibility and operating costs. By using a fiber node, we may be able to eliminate the active components in the coaxial part of the network to the home. This necessitates that the signal that is transmitted from the fiber node be strong enough to transit from the fiber node to the home without amplification. The signal then should be amplified at the home. This is accomplished by a low noise amplifier (LNA) in the home. The LNA also provides a means of supporting an increasing number of television, VCR and other display systems in the home.

The optical-to-electrical conversion will occur at the lowest level in the fiber portion of the network, i.e., at the fiber node (if it exists) or at the fiber hub, and will require the integration of the analog and digital source at that point. Amplification may be required depending on the proximity to the home.

The fiber node becomes a logical location for a PCS cell serving no more than 200 homes passed. Depending on cell size, cable is in a position to provide a home run fiber from each cell, or to deploy the Remote Antenna Driver (RAD), illustrated in Figure 6, to augment the transport of PCS services over the coaxial cable to and from the fiber node. The RAD is a distributed radio antenna that resides at strategic points on the coaxial tree/branch infrastructure and provides the communications path for voice signal over the coaxial plant.

This strategy also positions cable for wireless video entertainment in the more distant future. Broadband wireless video originating from the fiber node could allow cable to eliminate the drop cable, which represents 50 percent of the network infrastructure; a component of the network that is associated with better than 40 percent of the trouble reports in the network.

Assuming that fiber is deployed down to the fiber node level, and wireless broadband video some day becomes a reality, cable will have achieved an all-fiber network to the fiber node with broadband wireless to the home for entertainment video, voice and data applications.

It should be noted that, in evolving to the central head/fiber hub/fiber node architecture, some real systems may pass through an intermediate stage where there is no fiber hub.

This stage of evolution precludes the virtual ring capability between fiber hubs. However, if the fiber node serves at least 500 to 800 homes passed, there will be a need to provide some form of route diversity through a ring interconnecting the fiber nodes. The other concern with this migration resides in the fact that this type of deployment will likely include active components, such as amplifiers and line extenders, for a longer period of time until technological improvements are realized in lasers. Other concerns with this design arise from the long-term concern to support new applications and services, such as PCS, multimedia and some near-video-on-demand.

The consumer electronics interface will need to handle digital and analog signals. With the advent of advanced television, the need to provide digital and analog signals will become ever increasing. The LNA may be an integral part of the consumer electronics interface.

Passive coaxial distribution

The realization of a passive coaxial distribution network hinges on providing some form of amplification in the home. As consumer electronics equipment, such as advanced televisions, VCRs and CDs, increase in number in the home, the need for amplification beyond what is provided by the network becomes ever more important and may be needed even with conventional architectures.

By limiting the demand on the network and placing more demand requiring power in the home, this will provide for the possibility of a passive coaxial distribution network. It will improve the overall signal quality derived at each consumer device. The LNA may be integrated into the consumer electronics interface which may be part of the convertor or set-top box, or a separate device attached to the side of the home. Figure 7 illustrates the passive coaxial network design.

The need to migrate to a passive coaxial network is based on the requirement to minimize the number of connections to

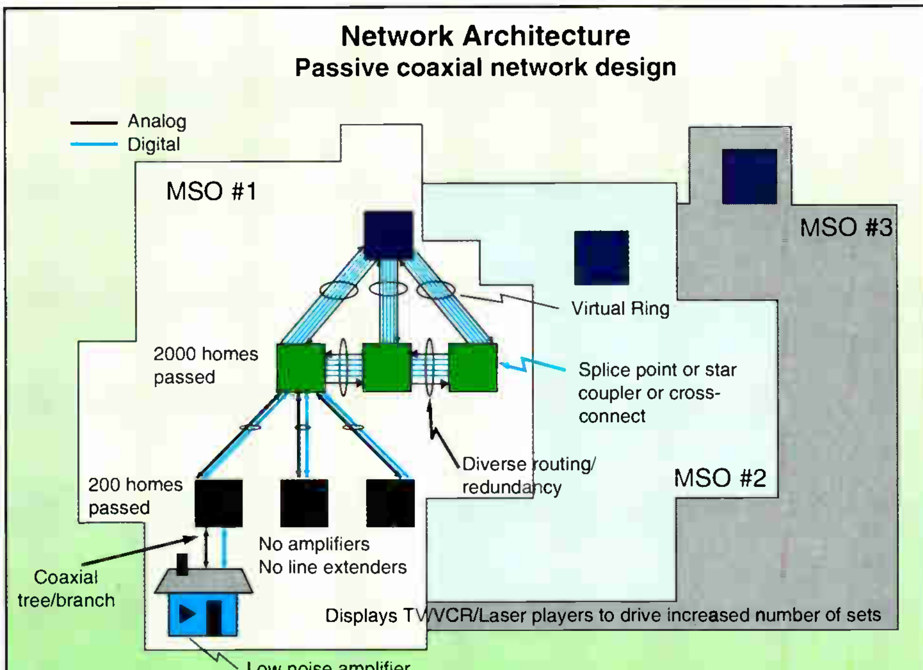

Figure 7

the power grid that affect multiple subscribers which will in turn improve the reliability of the network overall. The active components in the cable network derive AC power from the power utility.

The loss budgets of the splices in the fiber optics, and at the fiber hub and the fiber node, will be evaluated to determine how far fiber can be deployed and still drive a signal to the home. Losses associated with taps and set-top boxes will impact just how far the passive network can migrate.

Other issues that will impact the initial design of the passive coaxial component of the network include attenuation, system tilt, reverse and forward tilt, and micro-reflections. Micro-reflections are considered to be an issue that will require considerable attention.

Laboratory simulation

The passive network design tests will be performed at CableLabs in Boulder, Colo. The first test will consist of a fiber to the fiber node with a single amplifier and line extender. The second test will include only the amplifier in the coaxial, tree/branch topology. The third test will examine the network with a single line extender in the residential unit. The final test will analyze a totally passive coaxial network, outside of any amplification that may derive from the optical-to-electric conversion at the fiber node. Figure 8 depicts a diagram of the passive coaxial design. Each of these test configurations include an LNA in the residential unit.

A migratory path may, initially, include an amplifier or line extender between the fiber node and the residential unit.

It is apparent that some of the necessary advancements in component technology including improved lasers and LNAs, and reductions in distance limitations may be necessary before the full extent of this network design can be instituted on a technical or economic basis.

Network management

With the advent of the regional hub and the elimination of the active components on the coaxial cable, it becomes more easy to introduce automated network management.

In a typical cable system, most amplifiers are manually tested. When the test is performed the amplifier is removed from service. However, while the test is underway, those subscribers subtended from that point in the network are out of service.

Elimination of the active components, coupled with some form of automated network management capability, cable can improve the management of the network. This can lead to quality improvements and operating cost economies.

The need for network management becomes greater with PCS and multimedia applications. The existing approach to network maintenance is not reliable enough to support life-line services. The practice of removing an amplifier from service to test the integrity

of the amplifier cannot be tolerated. The passive network makes it easier for the cable operator to eliminate this component of network management and to introduce an automated approach, commencing with the introduction of the regional hub.

To introduce network management into the network, more is required than just the main and regional hub. This functionality requires not only the system, but a change in how the network is maintained.

While this may appear extreme, the notion of a passive coaxial component of the network may not be that far from becoming a reality.

Digital overlay

CableLabs also has been analyzing carriage of digital signals, mainly compressed video, above the 550 MHz spectrum. This concept is referred to as a digital overlay because it provides for transport of analog and digital signals together on the transport medium. The design will be largely driven by cost: Various modulation techniques are being considered, such as Time Division Multiple Access (TDMA), and channels carrying digital signals in a frequency division multiplex (FDM) format with each of four channels being multiplexed in the TDMA format, or simply FDM with a guardband between adjacent analog and digital signals. The size of the guardband will depend on filtering efficiency. This approach to transport of digital is being evaluated with parallel digital and analog fiber systems to determine the most cost-effective method.

Network Architecture
Network migration - passive coaxial design

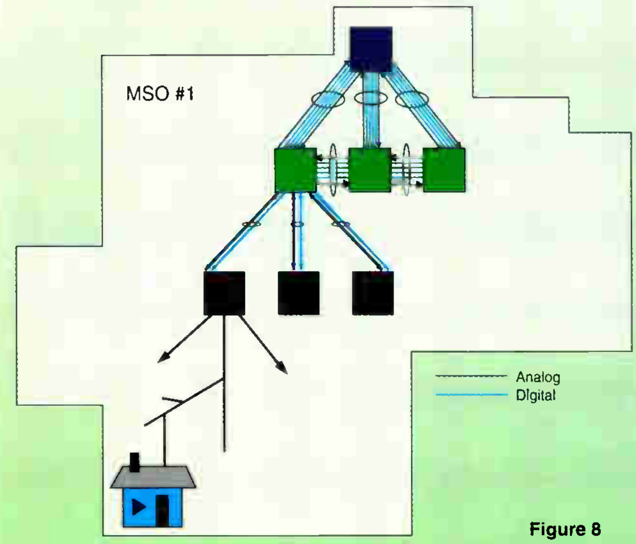

Figure 8

New applications

With the migration of fiber into cable network designs, reliability and improvement in signal quality and increased capacity is yielding many opportunities to transport new applications. These improvements and increased capacity have positioned cable to transport digital, as well as analog, video entertainment, along with many other applications.

At the same time as fibers are being deployed from the central headend to the fiber hub and then to the fiber node, additional unassigned fibers are also being included. As improvements occur in laser technology, the number of fibers that is required for transporting 60 to 80 video channels can be reduced from three to one. The spare fibers and the increased capacity based on improvements in laser technology will provide the cable operator with the capability to operate parallel networks within the same fiber cable sheath. This will allow for parallel digital and analog transport without any change in the outside plant.

Conclusion

The regional hub concept will provide the cable industry with the capability of migrating to a uniform service offering for large and small operators. The passive coaxial distribution network design will provide cable with a migration path toward a robust, reliable network capable of delivering a variety of services.

It will allow cable to increase functionality and reliability, to eliminate active components in the coaxial plant, and to migrate functionality lower in the network hierarchy as demand increases. In addition, it allows for rapid prototyping of new services, shared investment and benefit, uniformity of network access for large and small operators, and interoperability with other networks.

This evolutionary platform provides cable with a graceful path to migrate cost effectively into the future. CED

Polarization-induced performance variables

Polarization effects in optical fiber have resulted in rare occurrences of time-dependent CSO fluctuations. These fluctuations, which can exceed tolerable limits, have been traced to two mechanisms involving fiber polarization-mode dispersion, laser chirp and polarization selective elements. This article describes the impairment, the causes and the guidelines that can be followed to avoid such occurrences in the future.

Introduction

Development of fiber optic components for video systems to date has focused on laser transmitters and receivers, where continued improvements have resulted in significant payoffs. Fiber has been considered to be an essentially ideal low-loss substitute for coaxial cable. However, improvements in terminal equipment have unveiled certain non-ideal properties that can appear as performance-limiting factors.

One example of this is the intensity noise that results from multiple reflections in the fiber. Even if every splice in the system is perfect (zero reflectivity), scattering that results from the unavoidable fiber loss is sufficient to produce more intensity noise than even a mediocre DFB laser[1,2].

Fiber chromatic dispersion is another example of a fiber limitation that has only recently become a system limitation[3,4]. Dispersion forces the choice of fiber that is optimal at either 1.3 μm or 1.55 μm wavelength. Attempting to operate in the non-optimal window requires the added complexities of predistortion or equalization, and even so, these fixes have limitations.

Now we add another subtle fiber effect that can limit the performance of lightwave video systems. This effect was first observed as a time-dependent composite second order distortion (CSO) in an otherwise operable system. Random variations, from immeasurably small values to several decibels higher than allowed, were encountered. Time scales for these variations ranged from seconds to hours. Fast variations correlated to periods of changing outside environmental conditions, while the slower variations occurred in the quiet of night.

Suspecting that these strange correlations were because of temperature-induced polarization fluctuations, a thorough investigation was initiated. Mechanisms responsible for the CSO variations were identified and tested in both laboratory and field measurements. This article presents the results of this investigation, and suggests precautions that can be taken to avoid this rare but problematic phenomenon.

The interactions described involve very subtle effects that we've not needed to understand in the past. Because most readers will likely be unfamiliar with these effects, we've attempted to be as descriptive as possible. However, the issue is complex, and our description is unavoidably technical.

Perspective

Before describing the causes of the time-dependent impairment, the severity of this phenomenon must be put into perspective. More than 2,000 fiber links have been installed throughout the U.S. within the last two years. Effects that could be attributed to the mechanisms described in this paper have been observed in only three installations.

The effects are seen only on rare systems that involve combinations of extreme values of polarization-mode dispersion (PMD), laser chirp and polarization dependent loss (PDL). These will be explained later. Given typical distributions of these parameters, the likeliness of an observable impairment is small. But it has been observed, so safeguards must be put into place.

To complicate matters even further, several other effects can lead to time-dependent CSO values, especially at levels near the limit of measurement capability. Just to name a few, these include: Weak interferometers caused by imperfect splices or surfaces in an optical component, cladding modes improperly

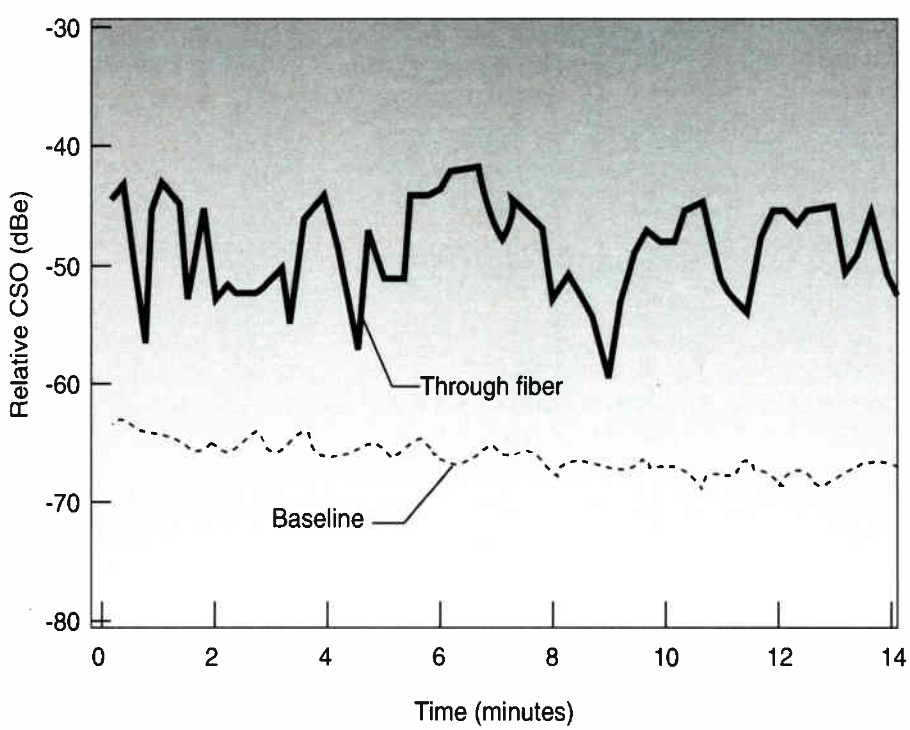

Figure 1

By T.E. Darcie and C.D. Poole, AT&T Bell Laboratories

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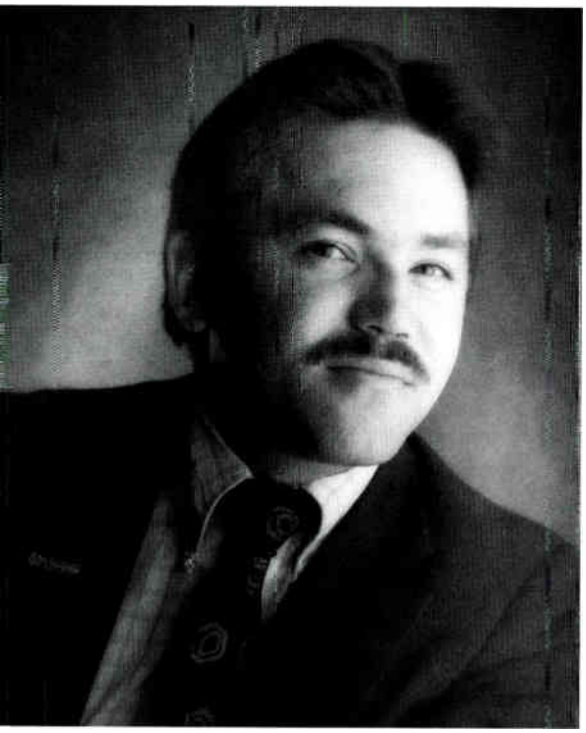

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stripped prior to a splice and reflections back into the laser. Each of these can cause intermittent problems, which are difficult to trace and can be aggravated by temperature variations. One cannot assume that any time-dependent CSO effect is caused by PMD, chirp and PDL.

Polarization mode dispersion

To many of us, the notion of single-mode fiber implies just that—the fiber supports only one mode that propagates with only one velocity. In actuality, "singlemode" fiber supports two "polarization modes." In an ideal fiber, these polarization modes are identical in every respect, except that the polarizations are orthogonal. Power in each mode occupies the same region around the core of the fiber, and the velocity of propagation of each is the same.

When light is coupled from a laser into a fiber, it is coupled into one or the other, or both of these polarization modes. In a perfect fiber, these two modes propagate to the output of the fiber, with no relative delay, and their superposition would reproduce the exact state of polarization that was launched into the fiber. This ideal situation never occurs in practice, however.

Any material that has an index of refraction that depends on polarization is "birefringent." All fibers have some degree of birefringence. This arises from slight variations in glass composition, internal stresses caused by preform fabrication or fiber drawing and external stresses from cabling or bends. Each of these perturbations contribute to slight differences between these otherwise identical polarization modes. Birefringence causes light in one mode to experience a net delay with respect to the other. The time delay between orthogonal polarization modes is polarization mode dispersion (PMD).

The net state of polarization at any position along the fiber, which is just the superposition of the two modes, depends entirely on this relative delay. This generally fluctuates with any change in stress on the fiber. Therefore, the state of polarization at any point along a fiber varies randomly as sun, wind or vibration manipulates the fiber cable.

In addition to the appearance of relative delays between polarization modes, power generally couples back and forth between the two modes. This will be referred to as polarization mode coupling. Signals that arrive at the receiver in one polarization mode will contain some light that has spent some time in the other mode. The detected signals then contain a mixture of delayed and undelayed signals.

Polarization-preserving fiber is the extreme limit of high PMD. This special fiber is designed such that these two polarization modes are very different. Light launched into the proper polarization then remains in that polarization, unable to couple to the other.

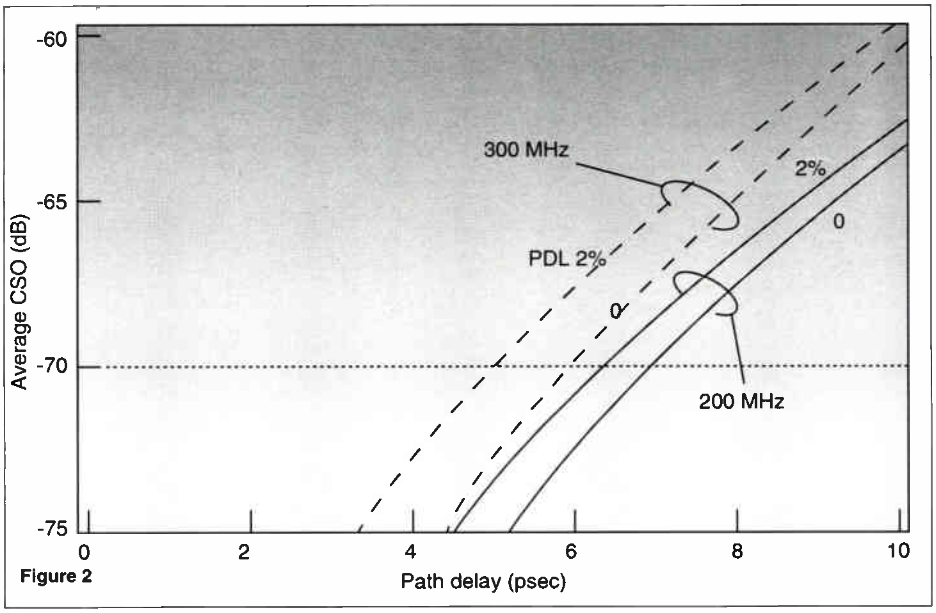

Figure 2

The delays incurred between different polarizations in fiber systems are similar to those in radio and satellite systems. The difference is that, unlike radio systems, the state of polarization cannot be controlled during transmission. Transmission through polarization-preserving fiber would be analogous to radio transmission through the air, but this is not a necessary or practical solution.

Difficulties in quantifying the effects of PMD on system performance arise from the random variations induced by even slight external perturbations to the fiber. Delays between the two polarization modes depend on the instantaneous mechanical state of the fiber, the states of polarization all along the fiber, the instantaneous optical wavelength and on the degree of mode coupling. The problem is a statistical mess, but numerous previous scientific investigations[5] have provided the groundwork.

PMD is best defined in terms of an average time delay between the two polarization modes. If the polarization mode coupling is strong, as is often the case in standard fiber, this average delay time is proportional to the square-root of the fiber length. We therefore refer to PMD as an average delay time per square-root length. Because the delays are typically extremely small, convenient units are pico-seconds per square-root kilometer($\text{psec}/\sqrt{\text{km}}$). Typical values of PMD ranging from hundredths to $4\,\text{psec}/\sqrt{\text{km}}$ have been reported[6,7]. It is also convenient to define the total "path delay," which is just the PMD times the square-root length, in units of pico-seconds.

Laser chirp

Laser chirp is the unintentional modulation of the frequency of a laser that occurs when the intensity is modulated. It results from changes in the number of carriers in the active layer of the laser when the current in the device is changed. This change in the number of carriers changes the refractive index of the laser structure, which changes the optical frequency selected. This optical FM is identical to radio FM, but at much higher carrier frequencies.

In DFB lasers, the amount of chirp varies greatly. Even lasers with nearly identical structures, operated under identical conditions, can have wide variations in the amount of chirp. Chirp depends on the material and structure that make up the laser, the modulation frequency, and on the exact details of how the DFB grating is formed in the laser cavity. Some of these variables can be controlled, but not all. Hence, a wide variation of chirp parameters can be expected.

For analog video modulation frequencies, it is usually acceptable to assume that the instantaneous optical frequency is proportional to the modulation current, or output optical power. Mod-

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ulation of the laser current then produces a modulation in the optical power, and a corresponding modulation of the optical frequency. The frequency shift resulting from the peak (one-half the peak-to-peak) modulation from one video carrier will be referred to as the chirp parameter C. Typical values of C range from 100 MHz to 500 MHz, with most recent devices in the range of 200 MHz to 300 MHz.

Polarization dependent loss

Polarization dependent loss (PDL) can occur in fiber splices, connectors, couplers, or when coupling to photodetectors, isolators or almost any optical component. It is simply any loss that varies with the state of polarization at the input to the splice or component.

PDL is observed easily by looking at the optical power received after the component in question, while varying the input polarization. Different polarizations will maximize and minimize this power, and the difference between these extremes divided by the average is the PDL. Care must be taken to remove other sources of power variation from the measurement.

Ideally, the PDL should be zero. Usually, though, some small amount of PDL is present. Typical splices have PDL values below 0.3 percent. Packaged photodetectors, which might contain a lens and/or bevelled fiber ends (to minimize reflections) have been measured to have PDL values that occasionally exceed one percent. Values less than one percent are considered small. Cascades of several splices and components can lead to appreciable net PDL values. Isolators and fiber couplers can have large PDL values, up to 10 percent. These must be used with caution in the receiver end of analog systems, as described later.

> Difficulties in quantifying the effects of PMD on system performance arise from the random variations induced by fiber perturbations.

Time-dependent CSO variations

The impairment caused by the combined effects of PMD, PDL and chirp has the characteristics illustrated in Figure 1. This data was obtained in the laboratory using 60 unmodulated carriers to drive a 1.3 μm wavelength DFB laser. CSO values vary at random over a range of at least 10 dB. The PMD-related CSOs can be greater than or less than the intrinsic CSO from the laser, and can add to it or cancel it completely.

Minimum CSO values less than the laser CSO are the result of this cancellation. Because this cancellation can lead to extremely small CSO values, the severity of the problem is not simply the magnitude of the CSO variations. Instead, one should be concerned with the average CSO and the maximum values reached.

To make the PMD-related impairment clearly visible above the intrinsic CSO of the laser, components were selected to maximize the effects. A DFB laser with anomalously high chirp was selected (C=700 MHz). Specially selected fiber with high PMD was used (PMD = 20 psec/$\sqrt{km}$). A pellicle, which is a thin transparent diaphragm, was inserted into the optical beam prior to the detector. By varying the angle of the pellicle, PDLs ranging from zero to 10 percent could be added. The fiber was placed in an oven so that the temperature could be stabilized or cycled. Measurements were taken over periods of time ranging from one to 24 hours, depending on the rate at which the temperature was cycled, so that long-term averages of CSO could be obtained.

Underlying mechanisms

Understanding the underlying processes by which chirp, PMD and PDL combine to generate a time-dependent CSO is a complex issue. After months of theoretical investigation and comparison with laboratory measurements, two distortion mechanisms have been identified.

The first and most easily understood mechanism involves PDL. PMD results in a delay between signals in different polarization modes. Different optical frequencies then suffer different phase delays, resulting in a frequency dependence of the polarization of the signal arriving at the receiver. Chirp from the laser then translates into a modulation of the polarization at the receiver. Any element with non-zero PDL transforms this polarization modulation into intensity modulation (IM). This unintentional IM mixes with the signal IM from the laser, resulting in second-order distortion.

> Installations with couplers or isolators after long fiber spans should be avoided. The high PDL of these components may be unacceptable.

A second mechanism

The second mechanism is less obvious. It appears when the delays between the two polarization modes are slightly dependent on the optical frequency. The process is analogous to that encountered with chromatic dispersion, which is the frequency dependence of the propagation delay. Just as chirp combines with chromatic dispersion to give CSO, chirp also acts with this frequency dependence of the PMD delays. Also, just as with chromatic dispersion, this component of PMD-related distortion increases with increasing modulation frequency.

The frequency dependence of the PMD delay, which drives this second mechanism, occurs only when there is coupling between the polarization modes. The distortion from this process is generated even if there is no PDL.

Both mechanisms have been confirmed theoretically and experimentally in the laboratory, and are consistent with what has been observed in the field. Which one matters most depends on many factors that are beyond the scope of this article. If future problems are to be avoided, extreme combinations of the contributing factors we've cited must be avoided.

Undesirable combinations

Approximate values of chirp, PMD and PDL that can be tolerated for a 60-channel system are shown in Figure 2. These values would limit the average CW-carrier CSO to -70 dBc. Provided that lasers with abnormally high chirp are avoided, the allowed values of PMD and PDL are commensurate with those readily available. Systems with lower channel loadings (36 to 42 channels) have less stringent requirements. The paths in the early vintage systems that exhibited objectionable time-varying CSO values had PMD and chirp on the high end of the ranges listed previously.

Installations with couplers or isolators after long fiber spans should be avoided. The high PDL of these components, as generally available today, may be unacceptable.

Summary

A thorough investigation into the causes of time-dependent CSO variations has been completed. Those variations caused by the interaction of fiber polarization-mode dispersion, laser chirp and the polarization selectivity of various passive optical components are now understood. The effects had not been anticipated, and involve phenomena that have not been of concern previously. Safeguards should now be put into place throughout this industry, by screening components for extreme offenders. CED

References

1. A.F. Judy, "Intensity Noise from Fiber Rayleigh Backscatter and Mechanical Splices," in *Proc. 15th European Conf. Opt. Commun (ECOC '89)*, Gothenburg, Sweden, September 1989.

2. T.E. Darcie, G.E. Bodeep, and A.A.M. Saleh, "Fiber Reflection-induced Impairments in Lightwave CATV Systems," *Journal of Lightwave Technology*, Vol. LT-9, No. 8, August 1991, pp.991-995.

3. G.J. Meslener, "Chromatic Dispersion-induced Distortion of Modulated Monochromatic Light Employing Direct Detection," *IEEE Journal of Quantum Electronics*, Vol.20, October 1984, pp.1208-1216.

4. M.R. Phillips et. al., "Nonlinear Distortion Generated By Dispersive Transmission of Chirped Intensity-Modulated Signals," *IEEE Photon, Technol. Lett.*, Vol 3., No.5, May 1991, pp.481-483.

5. C.D. Poole et. al., "Fading In Lightwave Systems due to Polarization-Mode Dispersion," *IEEE Photon, Technol. Lett.*, Vol. 3, No.1, January 1991.

6. N. Gisin, B. Perny, R. Passy, "PMD Measurements in Optical Fibers, Cable, Installed Terrestrial Cable and Fiber Ribbon," *Optical Fiber Measurement Conf.*, York, U.K., September 1991, pp.93-96.

7. N. Gisin et. al., "Comparison of Measurements of PMD on Single-mode Fiber," *Proc. Optical Fiber Conference (OFC '92), Poster paper WK5*, San Jose, Calif., Feb. 2-7.

8. C.D. Poole, T.E. Darcie, "Nonlinear Distortion Related to Polarization-mode Dispersion in Analog Lightwave Systems," *to be published.*

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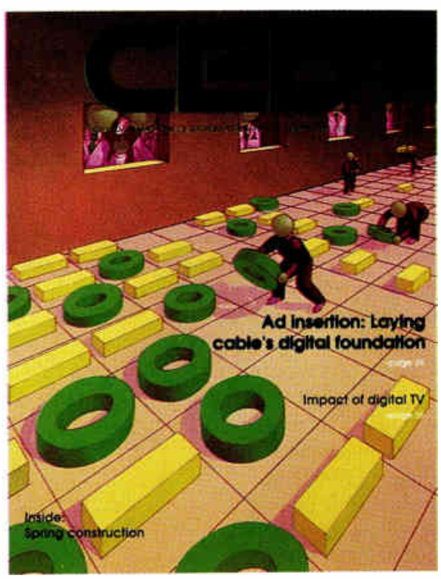

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Subscriber interface: Looming ever larger

Research by CableLabs, MSOs could offer solution

After years of stalemate and more than one false start, a solution to the interface paradox between consumer electronics and cable equipment is again being sought. The difference is that this time, the effort is being spurred by a threat of legislation, which in turn has gained the attention of cable chief executive officers.

The issue took on a high profile after Sen. Patrick Leahy (R-Vt.) introduced the Cable-Ready Equipment Act of 1991 last fall after he purchased an expensive television, only to learn that many of the features were rendered useless by the addressable descrambling convertor used by the system. Leahy was so miffed, he said, "I rise. . . today to speak out about cable TV, an issue which has the American people fed up, out of patience and ready for action."

The legislation's future is uncertain, but it has opened a Pandora's box. The issue has since been raised in many public forums, but an adequate solution remains elusive because it would require considerable expense by the consumer electronics manufacturers, the cable operators, or both.

Engineers have wrestled with the interface conundrum for years, only to be stymied by forces beyond their control. Members of the joint NCTA/EIA committee a few years ago settled on a baseband interface standard (popularly known as MultiPort) that offered relief, but the effort failed when cable operators refused to give up remote-control rental revenue and purchase the decoders. Television manufacturers, after building millions of MultiPort-equipped TVs, dropped the program when cable operators didn't buy into the program.

Interdiction

Of course, interdiction is another way to provide a controllable, broadband spectrum of signals into the home. But again, that technology has been slow to catch on as operators struggle with cost and powering issues. It's most recent go-round, which showed early promise and featured several high-profile trials, was nearly halted in its tracks by the advent of digital compression, which clouded its future.

Initially, Leahy's bill was going to require cable operators to deploy interdiction. Although that costly mandate was deflected by NCTA and others, the proposed legislation requires the FCC to establish regulations that would phase in MultiPort.

Specifically, Leahy's bill calls for:

- cable systems to use "friendly" signal denial methods such as traps and interdiction,
- the prohibition of scrambled basic channels,
- an optional purchase of the cable system's remote control unit, and
- the option of signal provision without a set-top convertor.

The threat of Congressional action caught the attention of cable's CEOs and Cable Television Laboratories, among others. Within CableLabs, a "terminal equipment study group" has been formed to explore the issue and possible solutions, according to Claude Baggett, director of consumer electronics systems. The group was scheduled to meet for the first time on April 15. Outside of a few engineers, the group consists of top executives, including: Jim Doolittle of American Television and Communications; Glenn Jones of Jones Intercable; Richard Roberts of Telecable; William Schleyer of Continental Cablevision; David Van Valkenburg of MultiVision; and others.

In advance of that meeting, Tom Jokerst of CableLabs/Continental Cablevision and Walt Ciciora of ATC wrote papers to help explain how cable got into this situation and some "quick fixes" to improve the predicament. Baggett also wrote a paper describing what happens if the cable industry chooses to do nothing. Baggett refused to disclose what the likely ramifications are if that is the course the industry takes.

"We want to put the decision-makers on the spot and have them tell us what to do," said Baggett. "We need a strategic, coherent plan for the interface, stretching out over several years. If we're successful in doing this, it'll be wonderful. It will help the (cable equipment) vendors and the consumer electronics (manufacturers) know what they're interfacing to."

Some new ideas

A few possible approaches have been advanced separately over the past few months by CableLabs and ATC engineers. Baggett himself is studying an approach, dubbed Adaptive Interface Unit, that would replace the set-top descrambling convertor with a device housing a central processor that's capable of accepting several plug-in modules. These modules could be built to perform such functions as video descrambling, digital decryption, provision of digital audio, interactive services, stereo sound, advanced television, etc.

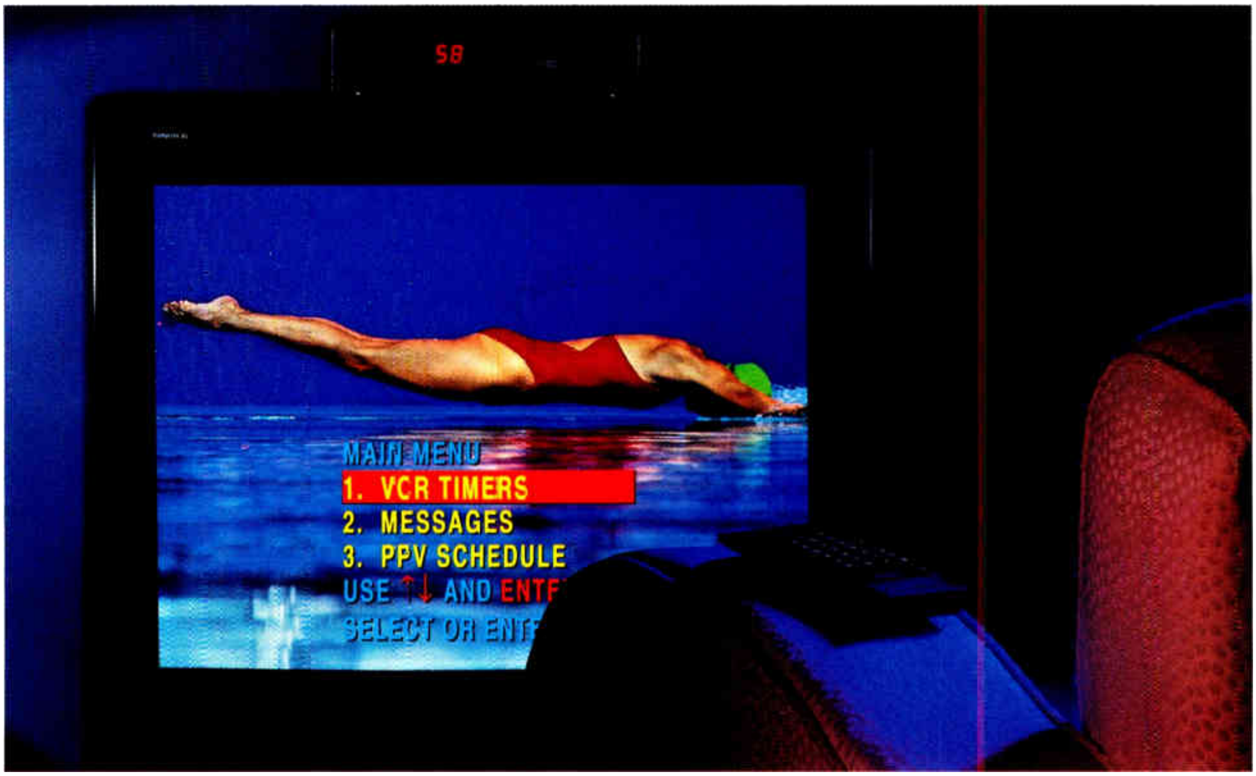
Under this scenario, it's possible to let the imagination run wild and predict that these plug-in modules could be sold in blister packs at the local electronics store. Consumers could then pick and choose what features are important to them and purchase accordingly.

"This is the way to implement the truly cable-ready TV," Baggett said in an earlier interview. It would "make it possible for the homeowner to upgrade any television" he owns and still be compatible with new services and features planned by cable operators, including electronic program guides and digital compression, added Baggett.

ATC's POE concept

Just a few weeks ago, ATC engineers publicly disclosed that they've been giving the interface issue much thought, too. During the annual Raychem CATV Symposium, Dave Pangrac, ATC VP of engineering, presented an experimental concept called "Point of Entry" that was designed to offer a "demarcation" point outside the home (see *CED* April 1992, p.8). The modular design could vary from something quite simple to a more sophisticated version with microprocessor control, he said.

The device would process a full 1-GHz of bandwidth while passing either 450 MHz or 550 MHz of channel capac-



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ity into the home and to the TV. With enough "brains," the system could be used in conjunction with the local power utility to help monitor and control energy load and demand. In fact, ATC plans to test that very concept in Denver later this year.

In actuality, POE is just one concept ATC has been studying and by no means is indicative of any direction the number-two MSO has taken, said Pangrac. Other, non-modular approaches are being considered to enhance the public's perception of cable TV and to make the consumption of cable service more pleasant, said Pangrac.

A series of focus groups have been convened to help ATC understand what viewers want. A series of options, including POE, dual-tuning convertors, and others, have been presented to the groups for their input. "We're frankly a little foggy on what the right answer is," Pangrac noted.

Encouraging signs

"I think this (decision to form a study group) is very encouraging," noted Baggett. "This is what we've needed for some time." Yet, in spite of the apparent breakthrough, Baggett said a true solution is still a long way off. "The implication is that if a solution is found, purchase orders will flow. But it (the solution adopted by the group) needs to gain a consensus among other operators because there's more than one solution."

Privately, representatives of both the cable and consumer electronics industries expect that Leahy's bill will eventually become a directive for the Federal Communications Commission to explore and mandate some form of solution. Therefore, it's advantageous for cable MSOs to adopt a long-range strategy before that day comes. "We're getting all the facts together, so that when they get ready to sit us down, we'll be spring-loaded for action," concluded Baggett.

Although the high-level action is encouraging, cable equipment vendors are reporting some limited resurgence in the adoption of interdiction and addressable tap technology by cable operators.

Scientific-Atlanta, the most aggressive marketer of interdiction, plans to introduce an enhanced system designed to pass up to 750 MHz. This would make interdiction compatible with digital compression when it is deployed as a tier of channels above 550 MHz of analog signals, said Gary Trimm, president of S-A's subscriber systems division. Although that approach would require an added investment in each home, the cost of the decompression device would be borne entirely by users of the technology, he noted.

Interdiction is "starting to turn around and receive more attention" now that much of the confusion surrounding compression is lifting, added Trimm. "Interdiction is the best approach to be compression-ready. That's actually bringing people back" to the technology, he noted.

S-A now expects to have 50,000 subscribers served by interdiction by this summer, he said. "We're still very optimistic about interdiction, but we're very realistic about the length of time it takes to deploy it, too," he concluded.

Interdiction's status

But other manufacturers report that interdiction is primarily dead, or at least in critical condition. Jerrold Communications, which has focused its efforts on improving the functionality of set-tops and remote control units instead of giving up the real-estate on top of the TV, says interdiction may have settled some issues, but offered new ones, too.

"The more we shopped (interdiction) around, the more we heard about problems, not solutions," said Dan Moloney, director of subscriber product management. "The concept was right, but the implementation didn't solve the problems that were put forth."

Those "problems," of course, include powering (who bears the cost? and are more power supplies needed?), the need to wreck-out a lot of existing plant to configure it most efficiently, and cost-per-port issues (the technology is deployed whether or not there are subscribing viewers).

But Trimm believes those issues can be overcome if an operator is willing to look at the long-term. In the five sites in which interdiction presently is operating, Trimm said the results in lift are nearly identical: pay penetration is up 15 percent; basic penetration is up 15 percent and customer retention and satisfaction is higher.

Among operators, it's clear that interdiction isn't dead—comatose might be a better word. Even Jones Intercable, which has its Elgin, Ill. system covered with interdiction devices, hasn't performed the type of marketing tests it takes to determine the long-term advantages of the technology. Options like preview weekends, pay-per-night, etc. are all approaches just waiting to be tried.

Other approaches

Vendors of less sophisticated addressable taps have been encouraged by the trend toward more friendly interfaces to consumers. AM Communications VP David DeLane says operators who may not want to invest heavily in interdiction are opting toward less complex devices that can connect and disconnect subscribers.

Several months ago, Cablevision Systems bought several units, primarily for MDU applications. DeLane said Cablevision "Is quite pleased" with the product and is actively looking for other areas—and other applications—to deploy it.

It's popularity seems to be growing, too. According to DeLane, Cox Cable will test AM's DropGuard device in Gainesville, Fla. in a university environment. A Cox system in Spokane, Wash. has already ordered an initial quantity of DropGuard and Intermedia Partners is planning to test 1,000 units in Tucson, Ariz., said DeLane.

Similar news emanates from Electroline, which has sold large quantities of its addressable tap technology throughout Canada, primarily for MDU and private cable environments. Electroline expects to debut its new electronic multi-tap for single-family residences during the National Cable Show in Dallas this month, according to Mitchell Olfman, Electroline president.

This new product integrates a low-pass filter in the unit to allow viewers to watch basic-only programming or add premium services when desired. A set-top would still be needed for premium services, however.

Get it right?

While it remains unclear what path the cable industry will follow to solve, or at least improve, the interface impasse, some technologists have expressed hope that with the advent of digital television, cable and consumer electronic vendors will capitalize on the chance to start all over again. This time, they hope to get it right. CED

By Roger Brown

Olympics Triplecast: Everybody's a critic...

But some non-addressable ops have their own ideas

Amid growing grumbles from manufacturers about paltry incremental revenues generated from the Olympics Triplecast, NBC and Cablevision Industries keep trudging along toward the July launch date. Despite the rumblings, many non-addressable systems from Texas to Kennebunkport, Maine are taking unique steps to offer the three-channel package to their subscribers.

The road to the PPV Olympics hasn't been easy. The effort has received reams of negative press from such titles as *Newsweek* and *Forbes*. Operators have strong-armed NBC/Cablevision into offering a one-day option, and are still looking for a one-channel option.

Early hopes for huge amounts of incremental, Triplecast-related equipment purchases—hopes that were high and strong last spring—have been dashed. Operators just aren't buying large amounts of headend or subscriber equipment to prepare for the 15-day event.

Then and now

It's not like operators haven't been prodded, says Joe Ostuni, VP of sales and marketing for Eagle, a trap manufacturer. Just last June (CED, June 1991, p.28) Ostuni advised operators to "Plan now. Buy now. Because there's no way we can make that many (6 million) traps come next April."

Well, April has come and gone. Did operators heed Ostuni's advice? "No. I've seen nothing in terms of incremental business from the Triplecast," Ostuni now says. "If I've booked 50,000 pieces for the Triplecast, I've booked a lot—and that's nothing," Ostuni laments.

Other trap manufacturers mirror Ostuni's sentiments. "We're seeing a lot of interest, but not a lot of orders," says Ken Augustine, VP of sales and marketing for Intercept Communications, a manufacturer who offered up a "disposable trap" for the Triplecast. The trap is battery operated and programmable to run during the duration of the event, then time-out.

"This is an ideal offering for something like the Triplecast," Augustine explains, "because when it times out, it's disposable. The benefit is the elimination of paperwork related to deposits, refunds and truck rolls." The only thing to look forward to now, Augustine says, is "possible windfall orders."

Charles Dougherty, Jerrold's product manager for headend systems, also thinks there's a possibility for a last-minute flurry of business one to two months before the Triplecast. Jerrold is another vendor who made specially-priced headend packages available to spur Olympics buys.

"The incremental business we've seen is not as large as some people in the industry had expected, for three reasons," Dougherty explains. "For one, operators may be using spare equipment. Or, they may be using equipment off another channel. Lastly, it may be possible that operators just haven't started to buy the necessary equipment yet.

Non-addressable strategies

Most of the deployment burden lies on the shoulders of the nation's non-addressable systems, simply because there are three different ways in which subscribers can buy the 15-day event. Without an addressable convertor, the Triplecast can seem like an implementation nightmare.

However, that isn't stopping many small, entrepreneurial systems. Prime Cable, for example, decided early on that the Triplecast was just too large and complex an event to run itself. So the Texas-based operator put together a "Triplecast task force," comprised of staffers from different divisions of the company.

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The force meets once a week to discuss implementation strategies and different problems that have cropped up, says Sandra Perry, a Prime group manager. In February, the task force organized a companywide meeting to discuss Prime's Triplecast strategies. "That way, all Prime systems will handle the Triplecast the same way," Perry says.

"Our systems are largely addressable, but that doesn't by any means imply that we're home free," Perry says. "Right now, we're bumping into considerable obstacles on the software side, with our addressable convertors—we use so many different brands," Perry says. The task force has set up test schedules prior to the actual event to ensure a smooth operation.

In St. Louis, Continental Regional Engineer Dick Beard has another approach. Although 95 percent of the system's 80,000 subscribers are non-addressable, Beard plans to offer all three flavors of the event. "We'll be offering all three packages. The weekend package is the one that's a real headache—it's a lot of back and forth. We'll just commit to the truck rolls for that. We don't want to cannibalize the event."

Beard plans to use traps to secure the Triplecast, but "not the three-trap bundle." Instead, he'll use individual traps, so that they can later be used for other PPV events. "It gives us flexibility beyond the Triplecast," Beard explains.

Spare equipment

It also seems Jerrold's Dougherty is correct about operators using spare equipment to handle the 15-day Triplecast. Take Laurel Cablevision of Litchfield, Conn., for example. According to Pam Little, marketing operations manager for the company, the small system will be using excess multi-level descramblers to facilitate the Triplecast.

"Now, we trap our premiums—but we used to use the MLDs, so that's what we'll be using for the Triplecast," Little says. The system will offer only the gold and silver packages (both full 15-day offerings), because "the bronze package is just too difficult to manage, in terms of deployment," Little explains.

A little farther north, in Maine, privately-held Cable TV of Kennebunkport will secure the Triplecast with converters. Claudia Richards, operations manager for the system, says that the "entire company" got involved with the decision-making process on how to best handle the event. "They'll certainly all be involved once it starts," she says.

The system did a PPV trial run last month, with a Wrestlemania event. "The subscribers who wanted the event came in and picked up the boxes, then returned them afterwards," Richards says. Pre-tuned to receive the pay channel, all outputs on the boxes were color-coded and came with an instruction manual. "We only had one call from a subscriber who couldn't get his hooked up—and he hadn't read the instructions," says Richards.

Why use convertors for the event? "We did some research, and discovered that more than 50 percent of our subscribers don't have televisions that tune high enough to pick up the channels we've designated for the Triplecast," Richards explains.

It's doubtful the private home of the President suffered from that malady—but have the Bushes subscribed to the Triplecast? "Not yet," Richards laughs. "And they didn't buy Wrestlemania, either." CED

By Leslie Ellis

 Circle Reader Service No. 41


EAGLE
COMTRONICS

The following companies have paid a fee to have their listing appear in the Consumer Interface callbook.

On Premise Addressability

Eagle Comtronics Inc.........(315) 622-3402
WATS....................................(800) 448-7474
4562 Waterhouse Rd.
Clay, NY 13041
PERSONNEL: Alan Devendorf, President; Joseph Ostuni, VP/Sales and Marketing, Chester Syp, National Sales Manager
DESCRIPTION: Eagle's addressable trap system is consumer friendly and available today. It incorporates eight tier switching, impulse pay-per-view selection, negative, positive or multichannel trap control, home powering through drop cable, parental control, downloadable credit unit, IBM PC control, external billing compatibility, store and forward return, and is economically comparable to converter-descrambler system.

Off Premise Addressability

COMMUNICATIONS
We're Keeping Watch!

AM Communications, Inc..(215) 536-1354
FAX.......................................(215) 536-1475
1900 AM Drive
PO Box 9004
Quakertown, PA 18951-9005
PERSONNEL: David L. DeLane, Vice President/Marketing & Sales; Joseph Rocci, Vice President/CATV Products
DESCRIPTION: DROPguard is a field proven family of addressable taps which includes outdoor units designed to directly replace passive taps in aerial or pedestal installations, and indoor units designed specifically to address dense, cost-sensitive multi-dwelling housing situations. Variations of DROPguard are available with output configurations ranging from 2 to 16 ports in most common tap values, and with powering from either the host cable system or from local AC mains. Thousands of DROPguard units are installed around the world, and the product has been proven to be robust and extremely reliable.

Scientific-Atlanta................(404) 903-6306
FAX.......................................(404) 903-5130
PO Box 105027
Atlanta, GA 30348
PERSONNEL: Nearest Scientific-Atlanta sales representative or (800) 722-2009.
DESCRIPTION: Results from operators using Scientific-Atlanta's addressable interdiction show increased basic and pay penetration, added revenues from additional outlets and more remotes, conversion of non-subscribers, fewer truck rolls and lower operating costs, and increased subscriber satisfaction with transparent consumer interface. Ideal for MDUs, hospitals, college dormitories, resort areas or other high density areas where there's high churn, theft or damage to converters. Family of products available today.

Pay-Per-View

Cable Technologies...........(215) 657-3300
International
FAX.......................................(215) 657-9578
Suite 109
2500 Office Center
Willow Grove, PA 19090-1222
PERSONNEL: Pete Morse, President; Bob Hipp, Account Executive; Carol Ritchie, Account Executive; Frank Salamone, Account Executive; Joan Wixted, Account Executive
DESCRIPTION: Sale/purchase of new and refurbished converters—plain, pay, addressable—all manufacturers; "made in America" remote handhelds—new—all manufacturers; batteries, video switchers, PPV equipment; low cost character generators; consulting for cable operators in use of IPPV, and addressability; marketing services; computer software development.

Eagle Comtronics Inc.........(315) 622-3402
WATS....................................(800) 448-7474
4562 Waterhouse Rd.
Clay, NY 13041
PERSONNEL: Alan Devendorf, President; Joseph Ostuni, VP/Sales and Marketing, Chester Syp, National Sales Manager
DESCRIPTION: Eagle's addressable trap switch offers 8 channels of pay-per-view or impulse pay-per-view. Operator controls ordering window from a month before the event to after it has started. Selections are as simple as an event number or a single letter. Subscribers may terminate an event anytime upon the discretion of the operator. Billing versatility is in increments of $.05 up to $50.00 per event in increments of 5 minutes. In-house or external billing available.

PIONEER COMMUNICATIONS OF AMERICA, INC.

Pioneer Communications..(201) 327-6400
of America, Inc.
WATS....................................(800) 421-6450
FAX.......................................(201) 327-9379
600 E. Crescent Ave.
Upper Saddle River, NJ 07458
PERSONNEL: David Nicholas, VP of Cable Systems Division; James Slade, National Sales Manager; John Unverzagt, Director of Engineering
DESCRIPTION: Pioneer offers PPV capability and provides a confirmation feature to reduce unnecessary CSR calls. For IPPV, Pioneer offers PULSE, which upgrades the BA-6300 to two-way addressability with telephone and/or cable return. Pioneer's BA-6300 with the PULSE option offers the advantages of IPPV ordering technology, viewer statistics collection and status monitoring. Pioneer also offers PLUS, a Lser Disc based system for playack and stand-alone PPV.

Scientific-Atlanta................(404) 903-6306
FAX.......................................(404) 903-5130
PO Box 105027
Atlanta, GA 30348
PERSONNEL: Nearest Scientific-Atlanta sales representative or (800) 722-2009
DESCRIPTION: Scientific-Atlanta offers a complete line of products and systems for IPPV including addressable set-top terminals with telephone and RF-IPPV options, and real-time control systems hardware and software. IPPV also allows periodic polling to determine number of viewers watching programs. The Model 8600 addressable set-top with its on-screen displays makes IPPV ordering easier and also includes on-screen confirmation and reminders before PPV event starts.

Traps

Arcom................................(315) 422-1230
WATS................................(800) 448-1655
FAX................................(315) 422-2963
PO Box 6729
Syracuse, NY 13217
PERSONNEL: Peter D. Warburton, VP, Sales & Marketing; Gregory A. Tresness, Technical Sales Director
DESCRIPTION: Arcom manufacturers the double density series of subscriber filters. Products include negative and positive mini-traps, tiering filters, and Gaussian filters. Arcom produces the smallest four-pole sharp trap in the industry.

Eagle Comtronics Inc.........(315) 622-3402
WATS................................(800) 448-7474
4562 Waterhouse Rd.
Clay, NY 13041
PERSONNEL: Alan Devendorf, President; Joseph Ostuni, VP/Sales and Marketing, Chester Syp, National Sales Manager
DESCRIPTION: Eagle's traps and decoding filters utilize advanced, state-of-the-art design, miniaturization, blocking capacitors, dual O-rings, polyurethyene foam, single board construction for ground continuity, soldered metal shielding and permanent channel identification. Complete line of US, PAL and Secam encoders. Best delivery of standard and custom units in the industry including the UHF spectrum.

Regal Technologies, Ltd.....(404) 449-0133
WATS (National).................(800) 36-REGAL
FAX................................(404) 416-1545
2100-A Nancy Hanks Drive
Norcross, GA 30071
PERSONNEL: Steve Necessary, President; Jack Bryant, Director of Sales and Marketing; Gaylord Hart, Director of Engineering; Jim Jennings, Director of Operations
DESCRIPTION: **Regal Technologies, Ltd.** is the industry's largest supplier of passive devices and is a leading supplier of basic converters. Product families include four varieties of house passives (including 600 MHz and 1 GHz versions), 600 MHz taps and line passives, the industry's broadest array of 1 GHz taps and line passives, ultra-reliable basic converters and the new "Silver Series" traps. The Silver Series traps utilize custom components to provide superior stability and notch depth for maximum signal protection.

Addressable Converters

Authorized Parts Co............(708) 658-6900
FAX................................(708) 658-0582
208 Berg St.
Algonquin, IL 60102
PERSONNEL: Sandra Litten, Midwest Sales
DESCRIPTION: Supply converter repair parts and equipment for Jerrold, SA, Hamlin, Oaks and others.We also buy and sell cable converters and other inventory.

Cable Technologies International...........(215) 657-3300
FAX................................(215) 657-3300
Suite 109
2500 Office Center
Willow Grove, PA 19090-1222
PERSONNEL: Pete Morse, President; Bob Hipp, Account Executive; Carol Ritchie, Account Executive; Frank Salamone, Account Executive; Joan Wixted, Account Executive
DESCRIPTION: Sale/purchase of new and refurbished converters—plain, pay, addressable—all manufacturers; "made in America" remote handhelds—new—all manufacturers; batteries, video switchers, PPV equipment; low cost character generators; consulting for cable operators in use of IPPV, and addressability; marketing services; computer software development.

Pioneer Communications of America, Inc...(201) 327-6400
WATS................................(800) 421-6450
FAX................................(201) 327-9379
600 E. Crescent Ave.
Upper Saddle River, NJ 07458
PERSONNEL: David Nicholas, VP of Cable Systems Division; James Slade, National Sales Manager; John Unverzagt, Director of Engineering
DESCRIPTION: Pioneer offers PPV capability and provides a confirmation feature to reduce unnecessary CSR calls. For IPPV, Pioneer offers PULSE, which upgrades the BA-6300 to two-way addressability with telephone and/or cable return. Pioneer's BA-6300 with the PULSE option offers the advantages of IPPV ordering technology, viewer statistics collection and status monitoring.

Scientific-Atlanta................(404) 903-6306
FAX................................(404) 903-5130
PO Box 105027
Atlanta, GA 30348
PERSONNEL: Nearest Scientific-Atlanta sales representative or (800) 722-2009.
DESCRIPTION: Scientific-Atlanta's Model 8600, the most advanced addressable terminal on the market, offers subscriber friendly features, on-screen displays and messaging capabilities. Features include channel name and number, and easy ordering and on-screen confirmation of PPV purchase with reminders when event is about to start. Other Scientific-Atlanta addressable terminals are fully electronic with microprocessor-based control. They are designed with a range of superior subscriber and operator features such as volume control, VCR timer, one touch IPPV buy key, extra surge protection, LED display, VCR compatibility and enhanced scrambling security. Many models compatible with Jerrold, Zenith, Oak and other suppliers. All models are available in an attractive, high-tech package.

Non-Addressable Converters

Cable Technologies International, Inc.

Cable Technologies International...........**(215) 657-3300**
FAX.......................................**(215) 657-3300**
Suite 109
2500 Office Center
Willow Grove, PA 19090-1222
PERSONNEL: Pete Morse, President; Bob Hipp, Account Executive; Carol Ritchie, Account Executive; Frank Salamone, Account Executive; Joan Wixted, Account Executive
DESCRIPTION: Sale/purchase of new and refurbished converters—plain, pay, addressable—all manufacturers; "made in America" remote handhelds—new—all manufacturers; batteries, video switchers, PPV equipment; low cost character generators; consulting for cable operators in use of IPPV, and addressability; marketing services; computer software development.

Panasonic

Panasonic Broadcast & Television Systems Company.........**(201) 392-4709**
FAX.......................................**(201) 392-6821**
One Panasonic Way 3E-7
Secaucus, NJ 07094
PERSONNEL: Richard Strabel, General Manager
DESCRIPTION: Manufacturers a complete line of non-addressable cable converters, both with and without volume control capability. The product features proven reliability, a standard 5 year warranty, and an unmatched subscriber brand name recognition.

PIONEER
PIONEER COMMUNICATIONS OF AMERICA, INC.

Pioneer Communications of America, Inc...**(201) 327-6400**
WATS...................................**(800) 421-6450**
FAX...............................**(201) 327-327-9379**
600 E. Crescent Ave.
Upper Saddle River, NJ 07458
PERSONNEL: David Nicholas, VP of Cable Systems Division; James Slade, National Sales Manager; John Unverzagt, Director of Engineering
DESCRIPTION: Pioneer offers the BC-4600 remote converter providing volume control/mute and volume control indicator. It provides 550 MHz, 83 channels, sleep timer, muted channel change, parental control with remote override and favorite/last channel recall. Programmable features include the output channel, frequency offsets, upper channel limit and channel and spectrum allocations.

Scientific Atlanta

Scientific-Atlanta................**(404) 903-6306**
FAX.......................................**(404) 903-5130**
PO Box 105027
Atlanta, GA 30348
PERSONNEL: Nearest Scientific-Atlanta sales representative or (800) 722-2009.
DESCRIPTION: Scientific-Atlanta non-addressable set-top terminals are designed with a range of superior subscriber and operator features, such as conveniently placed keys, stereo compatibility, infrared programmability, volume control, wide bandwidth and descrambling capability. All models are attractively packaged in the industry's smallest unit.

Remotes

Cable Technologies International, Inc.

Cable Technologies International...........**(215) 657-3300**
FAX.......................................**(215) 657-3300**
Suite 109
2500 Office Center
Willow Grove, PA 19090-1222
PERSONNEL: Pete Morse, President; Bob Hipp, Account Executive; Carol Ritchie, Account Executive; Frank Salamone, Account Executive; Joan Wixted, Account Executive
DESCRIPTION: Sale/purchase of new and refurbished converters—plain, pay, addressable—all manufacturers; "made in America" remote handhelds—new—all manufacturers; batteries, video switchers, PPV equipment; low cost character generators; consulting for cable operators in use of IPPV, and addressability; marketing services; computer software development.

Audio/Stereo

LEAMING INDUSTRIES

Leaming Industries.............**(800) 453-2646**
In CA....................................**(714) 727-4144**
FAX.......................................**(714) 727-3650**
15339 Barranca Parkway
Irvine, CA 92718
PERSONNEL: Kim Litchfield, Technical Sales; Keith Rauch, Senior Engineer
DESCRIPTION: Leaming Industries manufactures audio transmission equipment for the cable television, broadcast, and satellite industries. Our product line includes BTSC stereo generators, audio automatic gain control amplifiers, subcarrier equipment, FM stereo processors, STL equipment, and SCPC equipment.

Dist./Suppliers/Reps

Cable Services Company Inc.
2113 Marydale Ave., Williamsport, PA 17701 • 717/323-8518
1-800-233-8452 Nationwide

Cable Services Company, Inc....................**(800) 326-9444**
FAX.......................................**(717) 322-5373**
2113 Marydale Ave.
Williamsport, PA 17701
PERSONNEL: John B. Roskowski, President; George Ferguson, Vice President Sales; Robert Brantlinger, Director/Marketing
DESCRIPTION: Distributor of complete line of CATV products, including subscriber equipment. Also full line distributor of addressable and non-addressable converters. Cable TV stock products also include hardware, strand, aerial and underground cable, distribution electronics, connectors, system passive, drop and installation material, tools and safety equipment.

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Subscribers love the 8600.... On-screen functions upgrade older televisions to the state-of-the art and return features taken away from new televisions by other set-tops. Self-revealing menus in plain English make all 8600 features easy to use—even for adults. No more manuals or confusing message symbols. And pay-per-view becomes almost irresistible with program information, easy ordering and buy confirmation. Even automatic on-screen reminders when it's time to tune in. "Channel hoppers" love on-screen channel identifiers. And creative on-screen messaging by operators makes cable more appealing—with information on special program offerings, community events, service call coordination, special promotions and advertisements, traffic or weather warnings, even holiday or birthday greetings. So subs stay with cable, spend more on it and tell their neighbors to try it.

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Circle Reader Service No. 43

Signal leakage: The next logical step

In the CATV world, as in most business environments, economics is the driving force. Operators are constantly searching for ways to cut costs and utilize resources without sacrificing quality. By now, the differences between the yearly certification and quarterly monitoring methods are more pronounced. Much work and many resources are spent during the day-to-day monitoring and repairs on any plant.

A look at CLT's digital mapping system.

Mobile mapping

Unfortunately, the presentation of the accumulated data leaves much to be desired. One method to correct this is a mobile mapping system. With prices in such systems varying from around $10,000 to $20,000, one must find a system best suited to leakage monitoring needs.

A mobile leak detection and mapping system allows operators to choose the best way to utilize available resources. Operators can, for example, shuffle the equipment between service technicians for data collection during their normal routines, virtually eliminating the ride-out tech. Or, a continuous ride-out of the entire plant using minimally trained personnel can be performed.

With either method, the cost savings are tremendous because of the ease and quickness of data accumulation. The line tech and his bucket truck are not required to accumulate the data; line techs can be sent straight to problem areas with a digital map of the RF leaks found. At this time, the tech peaks out the leak at 10 feet and records anything over 50µV/m for use in the "I over infinity" formula.

Any mobile detection and mapping system has three major components. They are the RF detection device, vehicle tracking device and the interface device, along with its software which correlates the collected data into useful information.

RF leak detection

Let's consider the RF leak detection device first. In an imperfect environment where the pole line varies in distance from the road, it's impractical to expect that a technician or installer with a meter set to go off at a certain threshold can properly monitor a plant for leaks. While a spectrum analyzer might cover the entire spectrum of signals available, it's also expensive overkill for testing the magnitude of the leak.

We believe that using a frequency-specific meter such as Wavetek's CLM-1000 is more beneficial to the collecting of accurate data. These devices have the ability to tune in to any frequency (50 MHz to 550 MHz) chosen for monitoring.

It also has another feature which makes it invaluable for mobile leak detection—the ability to calibrate distance from the pole line into its RF measurements. By using this function, monitoring is meaninfgul as well as accurate. By connecting a remote, hand-held terminal to the unit and using function keys, the driver can maintain a fairly accurate vehicle-to-pole distance for proper RF signal strength.

With a properly calibrated meter and a good antenna, we have found that measurements made during the ride-out are very similar to the readings taken by peaking the signal on both its axes at 10 feet.

The interface/data collection aspect of this package demands certain things. First, the field equipment needs to be commercially rated for long trouble-free use in a bumpy, hot/cold environment. Second, the equipment needs to be user-

By Ken Eckenroth, Vice President of Engineering and Mike Ostteen, Vice President, Cable Leakage Technologies

friendly. A complicated and cumbersome system would collect more dust than data. Three, the system needs to be upgradeable. The fast-paced CATV, computer and navigation communities necessitate an open architecture in hardware and software.

Presenting the data

Maybe the most exciting aspect of mobile RF/axis detection is the presentation of the collected data. Instead of collecting addresses of leaks located in a daily log to be condensed and manipulated later, a map of the cable plant, complete with the approximate location of the leaks and their magnitude, is generated minutes after completion of the rideout.

Perhaps the most interesting part of this type of system is the means of navigational tracking. CLI has brought two of these to CATV, which are Loran and GPS.

GPS, or global positioning system, is a $12 billion satellite network created by the United States Department of Defense (DOD). When in full operation, it will have six to nine satellites in view from anywhere in the world, at all times. By far, it is the most sophisticated form of navigation on the planet. Seven dimensions can be derived from its information—three dimensions of position and three dimensions of velocity, as well as one dimension of precise time. (The time is so accurate it's almost magical.)

Loran has been around for decades. Loran C operates at around 100 kHz. Unlike VHF signals whcih have "line of sight" properties, Loran signals hug the earth and travel hundreds of miles. Location is then determined by triangulating on three or more stations in a chain.

Much has been written on both. Both are excellent sources for latitude/longitude or 2D location detection. But, for vehicle tracking purposes, the GPS wins hands down. Even with significant improvements and advanced calibration techniques giving it accuracy of 150 feet to 300 feet , the Loran can't be compared to the GPS.

Because of the relatively tight densities of some neighborhoods, the Loran system is not equipped to handle the job as well as the GPS. Also, Loran has problems with high voltage lines which make it a poor candidate for vehicle tracking. Loran does have the advantage of working well under dense foliage, where GPS (which is in the "L" band, at 1575.42 MHz) has trouble. However, if any light can get through, generally a moving vehicle can successfully track its path.

GPS offerings

The GPS provides a 3D (altitude), and a 4D (real time) that may have a CATV application in the future. For vehicle tracking purposes, 2D is sufficient. Street width accuracy (about 50 feet) is very common and to be expected with GPS. Unbelievable accuracies of one centimeter using GPS technologies such as P-Code, Carrier Aided Tracking and differential technology are also available. However, with price tags up to $66,000, these are expensive and unnecessary for this application. The important thing is to have equipment that is upgradeable to this accuracy if it is needed in the future.

GPS concerns

There are concerns about GPS, in-

Circle Reader Service No. 44

cluding the fact it is an incomplete system, having 17 of the 24 satellites in operation. However, sufficient coverage exists in North America at this time for most tracking purposes. This includes 22 hours a day of 2D coverage and 16 hours of 3D. Additional satellites are scheduled for deployment this year with a total completion date in 1993. The most recent satellite was launched on February 23 and put into service March 21. A computer program is available for monitoring satellite position and availability.

Selective availability

Another concern about GPS is a low level government test called "selective availability," or SA. The Department of Defense will intentionally degrade the signal to 300 foot accuracy using SA to ensure that in times of war, a foreign country cannot use GPS for hostile purposes. The DOD peaks SA infrequently, however, and information on whether or not it is activated is available from a Coast Guard telephone number.

A frequently asked question about GPS is: How many channels are necessary? GPS receivers ranging from one to 24 channels are available (there is even a 36-channel model). Anything over six channels is generally designed for surveyors for precise measurements, whereas a portable handheld receiver would be sufficient for a lost hiker. A GPS satellite broadcasts a sophisticated pseudo-random code along with a satellite system data health message which takes up to 30 seconds to complete.

In vehicle tracking, an update every one to five seconds is needed. A six-channel GPS, then, is the best choice for a high dynamic situation like vehicle tracking. In residential areas, 90-degree and 180-degree turns are common and come quickly while driving a vehicle. Also, continous six-channel receivers minimize an effect called GDOP (geometric dilution of precision).

The satellite's location in the sky will provide better geometric angles at certain times. A six-channel system tracks all the available satellites and picks the ones with the best angles.

This is much like a pool player selecting the best angle for a shot. A six channel receiver also provides a better signal-to-noise ratio than lesser receivers. They compare their channels to each other and calibrate out inter-channel biases. Another possible source of problems are multipath errors, which are similar to cable television's "ghosting" effects. This problem, which can cause substantial position errors, is corrected by advanced signal processing techniques using optimizing filter algorithms.

New directions

The GPS industry has some exciting new products soon to be released on the market that use GYRO technology for dead-reckoning techniques. Dead-reckoning refers to the ability of the GPS to track itself using vehicle movement sensed by the GYRO to detect the direction and velocity of the vehicle heading during momentary lapses of coverage. This will significantly help tracking in downtown areas dominated by high-rise buildings.

The future of cable vehicle tracking could go in several directions. RF snapshots, fleet management, contouring, design system integration, differential and dead-reckoning seem to be the most likely candidiates. The CATV community will decide which technologies are applicable and may come up with a few of its own. CED

Ad Index

Right of Access

Decoder recovery program

Editor's Note: *The following two articles on signal theft were co-winners of the fifth annual NCTA "Signal Security Ideas Competition," sponsored by the Office of Cable Signal Theft. The authors will present their winning papers at the National Cable Show during Education Session 19 on Tuesday, May 5 from noon to 1:30 p.m. in the West Ballroom C of the Dallas Convention Center.*

Heritage Cablevision of San Jose, Calif., a TCI company, operates a dual-cable 2,500-mile plant passing 285,000 homes in San Jose, Campbell, sections of Cupertino, and Santa Clara County contiguous areas. It provides service to 162,000 subscribers, with 88,000 premium/basic-plus customers using 91,000 Zenith addressable descramblers.

In 1985, it was determined that there was a need to access customers' homes when conditions existed necessitating inspection, maintenance, repair and/or removal of Heritage Cablevision's equipment (and equipment not installed by the company, but for which the system had some responsibility, i.e. leakage compliance, theft of service, signal degradation, etc.).

Contractual access consent

In response to that need, Heritage Cablevision, working in conjunction with the law firm of Olimpia, Whelan & Lively of San Jose, conceived the policy of a contractual right of access as a term of the subscription agreement. This "access to premises" states: "Subscriber agrees to permit agents of Heritage Cablevision access to subscriber's premises at reasonable times for the purpose of inspecting, repairing, replacing, maintaining or removing the equipment."

Subsequently, a policy and practice titled "Access to customer's home" was added, stating, "You authorize us to enter your home, . . . during normal business hours. . . , to install, inspect, maintain, replace, remove or otherwise deal with our equipment and service. You authorize us to. . . perform other tasks we deem necessary or desirable to enable us to render service." One of the tasks involved in rendering service is the preservation of a secure signal.

By Mark Solins, Director of Field Services, and Mike Barnard, Senior Investigator, Heritage Cablevision of San Jose

Unauthorized activity consisted of illegal connections, (addressed by a comprehensive audit program) and additional outlets until 1988, when reports surfaced that unauthorized descramblers, capable of decoding all pay services, had entered the system. Shortly thereafter, the first SSAVII unauthorized descrambler (with its attendant outbound convertor) was discovered pirating the signal. It became evident that a program was needed to remove such devices from inside the customer's home if the future of premium channels and pay-per-view events was to be secure.

Initially, a compliance program was attempted, using criminal/civil amnesty to promote the voluntary surrender of the unauthorized descramblers. This program was soon found to be anti-productive, because subscribers quickly learned to simply surrender their black box, with amnesty, then purchase a new, better replacement.

Further evaluation of amnesty programs led to the conclusion that they were successful predominately in systems whose own descramblers were being modified, thus establishing a future "day of reckoning" when the modified box had to be returned to the system, identifying the pirate. In the case of San Jose's system, subscribers were purchasing aftermarket descramblers, which are owned by the customer and whose location is unknown to the system.

Premium buy-rates began to decrease, yet Heritage could find no method of stopping the stream of illegal descramblers from entering the system. Electronic countermeasures implemented to combat signal theft were quickly circumvented, because of the "high-tech" nature of the subscribers of the Silicon Valley.

Heritage Cablevision again contacted counsel to develop a legally valid inspection/recovery program based on the previously contracted "access to premises" and backed by either criminal or civil penalties to combat recidivism.

Focus on civil suits

Research judged criminal penalties to be minimal, with the additional problems of overburdening a maximized criminal justice/court system which also requires a higher burden of proof for conviction. However, the California Penal Code, under section 593d, provides that "Any person who violates this section (pertaining to theft of service) shall be liable to the franchised or otherwise duly licensed cable television system for the greater of the following amounts: 1) Five thousand dollars ($5,000); 2) Three times the amount of the actual damages, if any, sustained by the plaintiff, plus reasonable attorney's fees."

Further, section 593(e) states "Any. . . system may, in accordance with the provisions. . . of the Code of Civil Procedure, bring an action to enjoin and restrain any violation of this section, and may in the same action seek damages as provided in subdivision (d).

Since subdivision (f) states "it is not a necessary prerequisite to an action. . . that the plaintiff suffered, or be threatened with, actual damages," a program was developed using the "access to premises" clause to make inspections of suspected pirates and civil penalties to prevent reoccurrence. In 1991, an inspection program was implemented which has since produced a 92 percent rate of inspection and a 74 percent recovery rate of unauthorized descramblers.

Gaining leads

Investigative leads are derived from a number of sources. The most effective are generated by a dedicated "Cable Theft Hotline"[1] driven by on-air theft of service spots provided by the NCTA's Office of Cable Signal Theft and edited for specific system needs by Heritage Cablevision personnel. In addition to being effective, these spots also provide a logged record of the number of illegal activity advertisements made by the system—an excellent prosecution tool to counteract the "I didn't know it was wrong" defense.

Informants are compensated by a reward system (paid in situations where a unit is recovered *or* inspection is refused [indicating some illegality within the residence]). However, the number of payouts is lessening as more informants indicate they are subscribers who are "just tired of paying while my neighbors steal the service."

"Disclosure lists"[2] provided by Jim

The voluntary surrender is always stressed, however, because it removes the descrambler from the system and saves the customer, yet compensates the system for lost revenue while leaving a strong message about the illegality of cable theft. Additionally, the voluntary surrender of the descrambler assures the unit does not move to a new and unidentified address within the system.

Descrambler removal

When the inspection is granted and the illegal descrambler is voluntarily surrendered, it is verified as being on line, activated to verify reception of unauthorized pay services, then removed by the investigators or subscriber with the legal installation restored. The unit is initialed and dated at the residence and a receipt stating "voluntary surrender," signed by both the subscriber and the investigator, is issued.

Investigators have in their possession a pre-addressed typewritten letter in the subscriber's name. This letter states the various violations of the law as applicable to the signal theft, provides the customer with details of the procedure which will follow and verifies that no criminal prosecution will be instituted by Heritage Cablevision.

This letter is signed and presented after the physical voluntary surrender of the descrambler has taken place. The entire installation is then checked for compliance to the existing agreement, and extra AOs, requested legitimate descramblers and premium services are added (the inspection right still exists for compliance follow-up).

When the descrambler is returned to the office, the subscriber's name, address and date of surrender are written on the bottom. A recovery date is affixed to one end (for later retrieval for court) and a copy of the surrender receipt is attached.

The box is logged on an evidence log and an account memo is made reflecting the date of voluntary surrender, box serial number, receipt number and any service upgrades. The box is then locked in a high-security evidence room to which only investigators have access, thus guarding against any allegations of conversion while preserving the unit for later litigation.

A final report is written, which includes the descrambler serial number, receipt number, level of subscriber cooperation, length of use if offered, other service irregularities, any statements offered or requested included by the subscriber, etc. and it, with attached documentation, is sent to the director of field operations for review and determination of action.

Cases for prosecution are sent to the local law offices of Olimpia, Whelan & Lively of San Jose, which handles the adjudication of civil penalties. This method has proved advantageous because it 1) divorces the adversarial proceedings from the cable system by name and 2) it allows the local law firm to personally deal with each violator to rectify their civil liability.

Program results

As earlier stated, in 1991, 92 percent of all customers ultimately admitted the inspection team and 74 percent of those inspections revealed unauthorized descramblers (in 18 percent of the inspections it was frequently found that a descrambler had existed but had been removed because of failure, fear of discovery, response to anti-piracy commercials, etc.).

In the remaining 8 percent (inspection refusals), two options exist. On absolute refusals, the customer's service is terminated and a letter explaining the reason—failure to comply with an inspection—is left. If the customer makes no further contact with the company (usually the case of a minor local seller, many illegal AOs, etc.), the account is terminated without further action. The account is permanently memoed to reflect that the customer may be a security risk and is not to be serviced without first contacting security.

On "qualified refusals," (those who call later and say they "misunderstood" or "the wife was in the shower" or "I was home alone," etc.) a policy has been instituted in which the service is initially terminated and may be later restored *only* after an inspection and the payment of a $60 reconnection fee (an increase is being contemplated). Premiums are then trapped to prevent further abuse and the customer consents to future inspections without reservation (further violations result in permanent termination of service).

Thus far, the cost of reconnection has been 100 percent effective in preventing reconnection of decoders which were not recovered during an inspection refusal. In these cases, the account is again memoed as a possible security risk, changes in service level may not be made without the permission of security and in cases where premiums are not desired, traps necessitate less monitoring.

The calendar year 1991 program results are shown in Figure 1 (with no prosecutions on any recoveries prior to April 1, 1991).

A revenue generator

Traditionally, security programs are not designed to generate revenue but are targeted to protect the resources of the organization. While the California Penal Code has given operators the latitude of criminal or civil actions, the program is equally applicable to other systems on either a civil or criminal basis, dependent on which codes provide the most effective method of customer compliance while serving the financial interests of the operator.

In 1991, the Heritage Cablevision Right of Access program removed 571 descramblers from the cable system/industry while generating $71,750 in actual revenue with an additional $156,000 in pending civil penalties.

The program has generated only one customer complaint (although recent press coverage instigated by a defense attorney has been negative—while at the same time generating a flood of new leads from legitimate customers) and has been responsible for numerous service upgrades, thus increasing revenue while adding to system integrity. Each surrendered unit provides additional intelligence on system compromises and potential modifications to legitimate descramblers while generating still more leads on illegal boxes.

Computations of figures provided in a recent issue of *Multichannel News*[4] indicate an annual industry impact of 1.3 million units, and does not include hundreds of "amateurs" modifying descramblers on a local basis. The Right of Access program leaves a strong, firm message with the pirate subscriber. The punitive penalties allow the program to be cost-effective, and at the same time increases the loyalty of paying subscribers who are no longer subsidizing those who steal. **CED**

References

1. G. William Dunderdale, "The Cable Theft Hot Line," *The 1988 "Signal Security Ideas Competition" collection of entries*, May 1988, p.14

2. Robert Blair, "Disclosure List," *The 1990 "Signal Security Ideas Competition" collection of entries*, Cable '90, p.14

3. Nicholas Giangualano, "Heightened Interest and Awareness of Cable Theft," *The 1990 "Signal Security Ideas Competition" collection of entries*, Cable '90, p.1

4. Janet Stilson, "Crime of the '90s," *Multichannel News*, Vol.13, No.6, 2/10/92, p.1

A comprehensive signal theft and security program

Cable TV Montgomery (CTM), located in the suburbs of Washington, D.C., is a subsidiary of Hauser Communications Inc. CTM serves a subscriber base of approximately 168,000 while passing in excess of 290,000 homes on a 3,100-mile cable system. During the first quarter of 1991, CTM realized the need to address the growing issue of theft of service in a comprehensive manner. Previously, theft of service issues were handled on a case-by-case basis, and it was clear this was no longer an adequate approach.

Cable theft, through the use of illegal pirate boxes, was proliferating at an alarming rate in Montgomery County. CTM estimated approximately 5,000 illegal boxes were in use in the county. The revenue loss was estimated at $12 million annually. Additionally, signal quality to all subscribers was in jeopardy because of equipment tampering. And, pressure was placed on all pricing because of revenue losses. Therefore, a multi-faceted plan was developed to address the issue of theft of service with particular emphasis on the illegal or pirate box problem.

Objectives

CTM established several major objectives at the beginning of its campaign:

1. To raise the level of awareness throughout Montgomery County that stealing cable was a serious crime and there are significant penalties if caught.
2. To prevent further stealing of cable services through the use of the latest and most sophisticated "encryption technology" that would render the illegal boxes useless.
3. To prevent businesses from distributing these illegal boxes in Montgomery County by using the legal system to the greatest degree possible.
4. To appeal to people's better instincts through the implementation of a multimedia campaign that included television spots, newspaper ads, news conferences, an anonymous tip line on our automated phone system, billstuffers and cable guide ads. The campaign's theme was "Stealing Cable Television: It's Just Not Worth the Risk!"
5. To develop a continuing, full-time system security program including the addition of a management-level position in the company.

During the first quarter of 1991, CTM was able to identify several individu-

By Francis Green, Director of Public Affairs, and John Cady Jr., System Security Manager, Cable TV Montgomery

Buried cable and technology change, Part II

Modeling lifetime costs of buried cable

In Part I of this two-part article, many of the factors that must be considered when deciding whether to directly bury cable vs. burying cable-in-conduit were surveyed. In Part II, a method for quantifying the cost differentials between direct burial (DB) and cable-in-conduit (CIC) is presented.

As with all decisions relating to engineering design and plant construction, the overarching criterion must always be the relative cost-effectiveness of the approaches available. When all is said and done, the role of an engineer is to balance the economic and technical trade-offs.

Drawing upon his technological acumen, the engineer then advises the operator, and those providing the capital support for the cable system, how best to proceed and what it will cost.

An extremely important variable in determining the cost-effectiveness of an approach is time. In the effort to keep capital costs down, should an approach be judged as cost-effective when the price of material purchase and deployment is low? Of course, the answer is yes if the price of deployment is of a short-term duration.

On the other hand, is an approach cost-effective when the price of material is low but that low cost results in higher deployment costs over the long term? The answer is, obviously, no.

These considerations may seem plainly obvious, yet it is surprising how often plant construction decisions are made without long-term factors and impacts playing appropriate roles.

"I can't speak for the industry," says Dick Mueller, vice president for technical operations for Cox Enterprises. "But Cox does not build the cheapest plant possible. We look at life-cycle costs. It's the only way to do it. We are an operator. We are not a short-term investor."

"Of the system operators I'm familiar with and the people in the construction field," Chuck Goy, director of construction with Colony Communications, advises, "I don't know of any of them who are building shortsightedly. Everyone I know is employing state-of-the-art construction techniques inclusive of conduit in almost all applications."

One consideration forcing some companies to give undue attention to short-term cost factors is the need to impress stockholders with quarterly profits. Privately-held companies like Cox and Sammons Communications are not under such constraints.

"Speaking for Sammons, we are budgeting for the long-term," says Bill Artz, national construction coordinator at Sammons. "We don't have to do anything that will impress Wall Street. So that gives us the advantage of making decisions that are soundly based on business and engineering criteria."

In the early 1970s, Sammons made a transition from immediate costs to a long-term cost analysis as it pertains to construction. "And it's proven, at least to my satisfaction, quite successful," Artz relates. "Underground, in particular, is one of those areas. It took me some convincing. I had to get the approval to go 100 percent CIC."

Modeling cable-in-conduit

cost of owning conduit
$0.50 x cost of capital for 15 years
$0.50 x $(1.12)^{15}$ .... = $2.74/foot

Cost of pulling for cable replacement
$1.00 x inflation rate for 15 years
$1.00 x $(1.045)^{15}$ ....=$1.94/foot

Cost of trenching & restoration....................=$ .00/foot

Total cost of replacement for CIC system ...=**$4.68/foot**

Modeling direct burial

Cost of owning conduit...............................=$. 00/foot

Cost of pulling for cable replacement..........=$ .00/foot

Cost of trenching & restoration
$5.00 x inflation for 15 years
$5.00 x $(1.045)^{15}$ ....=$9.68/foot

Total cost of replacement for DB system ....=**$9.68/foot**

Cost differential of CIC over DB in this example
$9.68 - $4.68 = $5.00/foot or 52%

Direct burial

Direct burial of coaxial cable and the burial of cable-in-conduit proceeds much the same way. However, most engineers would recommend the use of armored cable or a flooding compound to minimize cable damage during direct burial.

Open trenching can be performed prior to laying-in the cable. In many cases, such as a new housing development, other utilities have opened trenches and joint use is possible by prior arrangement and with specified spacing. But because the trench will be shared, conduit might be preferable to direct burial in order to minimize problems associated with re-entering the trench in the future.

Artz had an early experience which taught him a lesson. "We would put direct-buried cable in trenches as they were opened with the obvious intent of saving labor cost in the end," he said. "The amount of damage done to that cable between the time that we put it in the trench and when homes were built and we tried to run a tap out of it was tremendous."

The question of whether to directly bury cable or use cable-in-conduit is often answered by factors other than technical judgments. As Mueller relates, "It depends on where you grew up. I grew up in the Bay Area, so all the systems I've ever done have been conduit. But when I came to work for Cox 12 years ago, it was obvious that everything west

By George C. Sell, Contributing Editor

Data entry checklist

The following checklist can be used to create a cost analysis of direct-buried cable and cable-in-conduit.

1. Approaches to be compared (check one from each of two categories, DB and CIC):
DIRECT BURIAL:
a. ___ Non-jacketed cable, DB
b. ___ Jacketed cable, DB
c. ___ Non-jacketed cable, DB, with a vacant rigid conduit (PVC pipe) installed
d. ___ Jacketed cable, DB, with a vacant rigid conduit installed
CABLE-IN-CONDUIT:
a. ___ Non-jacketed CIC
b. ___ Jacketed CIC
c. ___ Non-jacketed cable in rigid conduit
d. ___ Jacketed cable in rigid conduit
2. Joint trenching used? Yes ___ No ___
3. Initial trenching and restoration costs: $______/foot
4. Retrenching and restoration costs in developed areas: $______/foot
5. Labor cost to install rigid conduit (PVC pipe): $______/foot
6. Labor cost to install direct-buried cable: $______/foot
7. Labor cost to install cable-in-conduit: $_______/foot
8. Labor cost to pull cable: $_______/foot
9. Material cost of rigid conduit: $_______/foot
10. Material cost of cable-in-conduit, above cable cost: $_____/foot
11. Cost of non-jacketed cable: $______/foot
12. Cost of jacketed cable: $_______/foot
13. Net salvage value of cable: $______/foot
14. Average quantity of cable replaced per project? _______feet
15. Management and operations expense associated with each cable replacement project: $_______avg./foot
16. Anticipated total life of type of direct buried cable compared: ______years
17. Anticipated inflation rate: _____percent
18. Anticipated annual cost of capital: _____percent

George Sell

of the Mississippi was in conduit and everything east of the Mississippi was not. And there's no technical reason for that. It has to do with managing philosophies of who ran the particular geographic division."

There are some situations where direct burial of cable makes more rational sense in both short- and long-terms. Goy explains: "There may be an upgrade where you are going back into a direct buried area and you have to replace a span to get the spec you need at the end of the line."

The added luxury of conduit protection for cable may not be a sufficient advantage if it is the *only* advantage. If direct-buried cable will remain in the ground and will not need to be replaced, for reasons of either degradation or obsolescence, for decades to come, then the additional expense of conduit makes little sense.

"Having been raised on the West Coast and built thousands of miles of plant using conduit," says Mueller, "I had a very difficult time with those Cox systems on the East Coast that were direct buried. And over a period of years they have convinced me and I have seen it with my own eyes that the degradation of direct buried cable is nowhere near as bad as I assumed it would be when I was doing conduit systems."

Mueller considers dig-in damage the most likely problem with direct-buried cable. "Your biggest exposure, as it is with conduit, is being cut. Whether it's a guy digging a mailbox in or someone installing a sprinkler system, that is your biggest concern," Mueller says.

But Goy points out that dig-in damage to cable-in-conduit isn't as catastrophic as damage to buried cable. "Even if the conduit was damaged, center span, you can dig down to it, repair it, and re-pull through it. So, from a maintenance aspect or a rebuild aspect, it has its advantages."

Of course, direct burial has the advantage of low material costs. However, this may be the only cost advantage of direct burial, even in the short term. Often greater care must be taken during installation, which translates to higher labor costs.

Cable-in-conduit

According to Artz, in most construction projects, more installation vehicles may be necessary when directly burying cable. With CIC "you don't have to be as careful with the preparation of your trench line. And that goes directly to the bottom line of manpower for the contracting."

Artz saw this differential early on. "When we first started using CIC, I was getting bids 10 and 15 cents a foot lower to place the CIC than the direct-buried cable. It took fewer workers to do it because they didn't have to be as careful, it didn't take the trench preparation that direct buried cable took if it was being done properly, and contractors didn't end up buying as much cable, frankly, as with direct buried cable.

"Obviously, if they screwed it up when they were putting it in, they bought it. With CIC cable, there was no reason for anyone in that crew actually to touch that cable until the splicer gets there, and then you're talking about a skilled laborer or craftsman who knows what he is doing."

Artz has developed ballpark figures for a mile of underground plant. "The numbers I have are based on 100 percent use of CIC corporate wide. I budget for a mile of underground plant at $28,200. That's complete: the mapping, the design, cable, electronics, everything. These figures are developed from actual job expenditures."

Cable-in-conduit, at least for Sammons, has proven itself. "As the number of miles we have installed CIC (rises), there have been corresponding drops in overall maintenance cost of underground plant," Artz reports. "Our purchases of direct buried cable for maintenance have gone from a quarter-million feet per year in the early '80s to probably 50,000 feet a year."

Goy of Colony agrees. "Anybody who is looking at building systems, extending systems, or rebuilding systems, and looking at their current operating and maintenance costs in areas where they have direct buried, it becomes very apparent the advantage of using cable-in-conduit and conduit application techniques in all construction.

"We are about to rebuild some California properties that were placed between the late 1960s and the present. We are going to bring these systems up from 300 MHz to 550 MHz. In a lot of cases, that calls for total cable replacement, plus we're going to drop in some fiber.

"We're finding, after doing an experiment with the conduit system, that we are probably going to be able to reuse 90 percent of that conduit. That's our initial estimate.

"We are talking about re-pulling cable through existing duct at a cost of somewhere between $1 and $1.50 a foot compared to rock sawing at between $7.50 and $10 a foot," Goy explains. "That's a big deal."

Modelling the costs

The purpose here is to provide the reader with a model with which to analyze their own particular cost factors (see sidebar accompanying this article). As always, when developing a method for modelling cable plant construction costs and attempting to plug in cost factors that are meaningful, one must seek to provide real-world numbers.

For long-term factors to play an appropriate role, they must be known and quantified. For the numbers used, several sources have been used to derive average numbers. Of course, any given cable system may have conditions which would generate perhaps significantly different numbers.

For example, direct labor costs may vary widely from region to region. Construction and future reconstruction costs will greatly differ between an urban area and a rural or suburban area. Regional environmental factors will also be different (soft soil is easier to trench than rock).

Another is buying power. "We all negotiate different deals," Goy points out. "My numbers might be a little different from an MSO that has 100,000 subscribers. And I'm sure that TCI's numbers might be better than mine. It all depends on what your buying power is and buying power can make (conduit) use more attractive."

As discussed in Part I, there are costs assumed to be common for direct burial and cable-in-conduit. Therefore, they aren't included in the model. They are:

1. The same reel trailers could be used for both (as long as the width of the conduit and length of the continuous run are within standard parameters).
2. The number of installation vehicles necessary to install a certain footage over a fixed period of time.
3. The first-cost of trenching.
4. The direct labor first-costs.
5. An inflation rate of 4.5 percent for labor and equipment is assumed.
6. The annual cost of capital is assumed to be 12 percent.
7. The time period analyzed is 15 years.

The costs assumed to be different between direct burial and cable-in-conduit over the life cycle of a cable plant include:

1. The cost-per-foot of 1.25-inch conduit.
2. The cost-per-foot of trenching and restoration for future replacement of direct-buried cable.
3. The cost-per-foot of pulling cable for future replacement of cable-in-conduit.

There are other cost factors that are different between direct burial and cable-in-conduit that will not be included in the model due to their intangible nature. Some of these are: additional cable life due to conduit protection, conduit reduction of dig-in damage, and ease of plow-in with conduit, which results in reduced construction labor costs. And conduit protects the cable from attack by rodents while making the pulling of fiber easier.

Conclusions

An investment that costs 50 cents per foot today compared to the cost of replacement for direct burial, which is $9.68, minus the cost of pulling cable through an existing conduit system ($1.94), saves $7.74 per foot. This amounts to an internal rate of return in 15 years of 20 percent.

$\$0.50 \times (1.20)^{15} = \$7.74$.

If one considers the funds spent on conduit as money invested for the future, which will have a payback in 15 years with an internal rate of return of 20 percent, compared with other investments such as stocks, bonds, real estate, etc., most would see a conduit system as a good financial decision with low risk.

The intention has been to present as simple a model as possible, employing cost figures that are average and reasonable. There may be other cost factors and specific conditions that will impact the analysis of any given project. It is recommended that the reader make use of data gathered from his own situation and apply the model presented, or modifications to the model, to determine his costs and/or savings. The reader can use the accompanying sidebar for data gathering.

Acknowledgments

The author wishes to acknowledge the assistance of those interviewed, and other personnel, at Sammons Communications Inc., Colony Communications Inc., and Cox Enterprises Inc., as well as Rodney Machac and Scott Lumley of Integral Corp. CED

Editor's Note: *In Part I of this article that was published in the April 1992 issue, the photograph of the trencher should have been identified as coming from Cable Services Co. It was taken during a construction project in Ponce, Puerto Rico.* CED *regrets the omission and thanks Cable Services for use of the photo.*

SCTE®

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

May 12 *Central Illinois Chapter* "Lightning, Grounding and Power." To be held at the Holiday Inn, Brandywine, Ill. Contact Chuck Prosser, (309) 347-7071.

May 12 *Desert Chapter* "Fiber Measurement" with Bob Tenton. To be held at Time-Warner offices in Flushing, N.Y. Contact Rich Fevola, (516) 678-7200.

May 12-13 *Ohio Valley Chapter* "Video and Audio Signals and Systems" and "Smart House." Consecutive meetings to be held May 12 in Cincinnati and May 13 in Cleveland. Contact Jon Ludi, (513) 435-2092.

May 12-13 *West Virginia Mountaineer Meeting Group* "OSHA and Safety." Consecutive meetings to be held May 12 at the Ramada Inn in Charleston, W.Va. and May 13 at the Holiday Inn in Clarksburg, W.Va. Contact Joe Jarrell, (304) 522-8226.

May 13 *Cascade Range Chapter* BCT/E exams to be administered in all categories. To be held at Paragon Cable offices in Portland, Ore. Contact Cynthia Stokes, (503) 230-2099.

May 13 *Florida Chapter* BCT/E exams to be administered in all categories at the technician level. To be held at Continental Cablevision offices in Pompano, Fla. Contact Pat Skerry, (904) 735-1571.

May 13 *Great Plains Chapter* "Coax/Fiber Upgrades" to be presented by Scientific-Atlanta, "Fiber-to-the-feeder" presented by C-Cor and "Future Applications" to be presented by ONI. To be held at the Crown Court Quality Inn, Bellevue, Neb. Contact Jennifer Hays, (402) 333-6484.

May 13 *Oklahoma Chapter* Contact Arturo Amaton, (405) 353-2250.

May 13 *Magnolia Meeting Group* "Compression Technology" with Bob Luff of Scientific-Atlanta and "Coaxial Cable Characteristics" with Chris Cooper of Times-Fiber. To be held at the Ramada Inn Coliseum, Jackson, Miss. Contact Steven Christopher, (601) 992-0445.

May 14 *Mid-South Chapter* "Compression Technology" with Bob Luff of Scientific-Atlanta. To be held at Howard Johnson's, Senatobia, Miss. Contact Scott Young, (901) 365-1770, ext. 4150.

May 14 *Penn-Ohio Chapter* "Safety: Everybody Needs It!" To be held at the Sheraton Hotel, Warrendale, Pa. Contact Bernie Czarnecki, (814) 838-1466.

May 14 *Satellite Tele-Seminar Program* Earth Station Site Planning produced by Microwave Filter. To air from 2 p.m. to 3 p.m. Eastern time on Transponder 6 of Galaxy I.

May 14 *Wheat State Chapter* BCT/E exams to be administered in all categories. To be held at the Red Coach Inn, Wichita, Ks. Contact Mark Wilson, (316) 262-4270.

May 16 *Golden Gate Chapter* BCT/E exams to be administered. To be held at Viacom offices, Pleasanton, Calif. Contact Michael Gorin, (510) 534-3364.

May 17-18 *Old Dominion Chapter* To be held at the Holiday Inn, Richmond, Va. Contact Margeret Davison, (703) 248-3400.

May 18 *North Country Chapter* Installer exams to be administered. To be held at the Sheraton Midway, St. Paul, Minn. Contact Bill Davis, (612) 646-8755.

May 18-20 *Technology Update '92, Seminar and Trade Show* Eighteenth annual northeast technical seminar and trade show sponsored by the New York State Commission on Cable Television and the SCTE. To be held at the Roaring Brook Ranch, Lake George, N.Y. Contact Al Richards, (518) 474-1324.

CATV, telco alliances explored at ComForum

Exploration of the need to form strategic alliances between cable operators and telephone companies was the underlying theme of the Spring ComForum on Fiber in the Loop technology held in Dallas in late March, but it became apparent to the 400 attendees that telcos have more to gain from these partnerships than cable operators do.

Yet, representatives of the cable television industry were preaching the benefits of these strategic partnerships with telephone companies during the ComForum, sponsored by the National Engineering Consortium. Industry observers privately wondered if cable's olive branch offering was little more than a token effort designed to assuage the telcos' regulatory efforts to enter the video entertainment business.

Dr. Richard Green, president and CEO of Cable Television Laboratories, set the tone of the gathering during his luncheon keynote speech by calling for increased—albeit cautious—cooperation between cable and other industries, including telcos.

"We must re-examine old turf battles and recognize that the future information society. . . will not be reached by. . . continuing to develop techniques and systems in competitive isolation," said Green to an audience made up of primarily telephone industry representatives. "Collectively, we are the weavers of the communication society," Green added. "The glass fibers that we daily spin into our networks will provide this society with the fabric to indeed 'leech us of our ill'."

But at least one cable operator in the audience wasn't swayed by Green's conciliatory remarks. Harry Cushing, an executive with Telesat Cablevision, an overbuilder and operator of cable systems located primarily in south Florida, warned the telcos not to be suckered by cable's new stance on mutual cooperation.

"Imagine doing a partnership with Dr. Hannibal Lecter (the cannibalistic murderer featured in the film *The Silence of the Lambs*)," said Cushing. "This is the traditional cable operator's idea of a partnership: Today it's a kidney, tomorrow it's a lung. This goes on until you don't have anything left to give them."

Cushing said Telesat's presence as a competitor has increased cable penetration while forcing the established cable operator to reduce prices, sometimes by as much as 50 percent. And Cushing denied that competition isn't economically impossible, despite efforts by the NCTA to show that the opposite is true.

But Cushing's real message was that Telesat—and other overbuilders—are "ready, willing and able" to partner with local telephone companies by leasing the telco's fiber to distribute video signals. "I'd much rather spend (the money Telesat presently spends on network construction) leasing space from you," he added.

"Don't study this for another five years," admonished Cushing, "get into the business as a competitor (to cable) now. You must fight back against cable operators who are coming into your business."

Indeed, cable systems are poised to offer a variety of enhanced services over networks rebuilt with large amounts of fiber optic equipment, said Geoff Roman, VP of technology and new business development at Jerrold Communications. Roman described the cable industry's efforts to increase bandwidth capacity via compression and its experiments with personal communications services.

The telco representatives were given notice by Bob Luff, VP of strategic operations at Scientific-Atlanta that cable operators are becoming powerful competitors for video entertainment, advertising and perhaps telephony dollars.

That message was further hammered home by Alan Pearce, president of Information Age Economics. "I believe the cutting edge of fiber deployment is coming from the alternate access and cable companies—not from the telephone companies," he said.

Furthermore, Pearce said the cable industry isn't resting on its laurels. "The Teleport acquisition (by Tele-Communications Inc. and Cox) is of paramount importance to this (telephone) industry," Pearce noted. He predicted that TCI and Cox would eventually reduce their interest in Teleport to about 30 percent each, and sell off equal shares to US West and Cable and Wireless. Nevertheless, he said the move should set off alarms all across the telephony world.

"It looks as though the cable industry is ready to dominate the two industries" (telephone and broadcast) it was protected from by law and regulation in its infancy, he concluded.

Despite these warnings, the cooperation theme was sounded in session after session, by both cable and telco voices.

CED, NCTI host safety seminar

The cable television industry loses more workdays and experiences a higher incidence of on-the-job injuries per 100 employees than the telephone and electrical industries combined, according to government statistics. That news was presented to about 55 system- and corporate-level cable safety officers during Safety '92, a two-day symposium held in Denver in April and co-sponsored by the National Cable Television Institute and *CED* magazine.

The lost productivity translates directly to a cable system's bottom line, according to George Taylor, president of consulting firm Taylor, Morris and Assoc. of Denver. Taylor added that OSHA isn't "the bad guy who's out to get you, they (OSHA inspectors) are there to help you."

Taylor did note that cable has improved its overall safety record, but cautioned that it still is out of control. Although the phone and electrical industries employ seven times as many people as CATV, cable has 5.5 times as many accidents, he noted.

One reason is that the industry is just beginning to focus on safety as an issue. Up until recently, CATV has been in a construction phase, racing to wire the country for service. Now that most of that has been completed, systems and MSOs are beginning to realize they can reap the benefits of reduced insurance premiums and workman's compensation claims by operating more safely.

Indeed, safety requires a change in attitude and cooperation from employees and the employer, says Gary Lietz, safety engineer with the U.S. Department of Energy. In order to manage work, people, hardware and procedures have to operate harmoniously. The role of safety is twofold, says Lietz: 1) to develop and maintain a safety process (not a safety program); and 2) reduce or eliminate barriers that prevent safe behavior and conditions.

"Safety doesn't just happen," noted Lietz. "If there is an accident (at your system), it was premeditated. An accident or injury should tell you your safety program has failed," he added.

The keys to developing and implementing an effective safety program are support from the top levels of management, authority to shut down an unsafe

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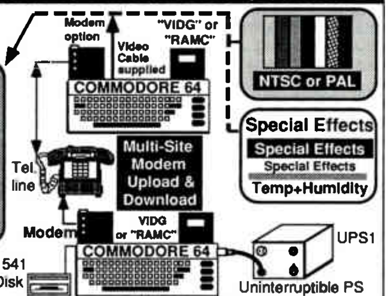

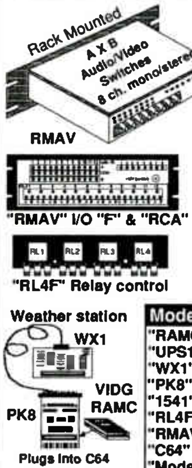

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Science fiction? Perhaps. Certainly the technology is not beyond credibility. In fact, engineers can do most anything given adequate motivation, time and money.

The technical feasibility of low earth orbit (LEO) satellites and very small satellite antennas (VSAT) is not chimerical. It has been investigated at least enough for WARC-92 to allocate frequencies for LEO transmissions, and to support Motorola's Iridium and London-based Inmarsat's Project 21 proposals.* More than likely, the concept has also been investigated, if not actually tested, for classified military communications. Development is not yet entitled to designation as state-of-the-art in the commercial sense.

Economic viability

Two important questions beg for answers: What would such a system cost to create and operate? Who would pay for it?

The concept seems to be touted by sources traceable to telephone utilities and the military-industrial complex. Life-long careers associated with telephone utilities and the military are not particularly conducive to developing significant expertise in evaluating consumer market potential.

Pennies to millions

An increase of a few pennies a month for telephone service can generate hundreds of millions of dollars in increased revenue without risk of disconnects or defections to competitors. A favorable bottom line is virtually guaranteed.

Reality has been known to outstrip even science fiction. But predictions of the demise of terrestrial broadcasting and some form of cable TV are assuredly premature.

There is no realistic way to evaluate the cost of military hardware comparable to voluntary individual purchases in the consumer marketplace. The income required for new weapons systems comes from mandatory tax collections from citizens who are not permitted to make the willing buyer judgments that are the basis of entrepreneurial enterprise.

No tax for video

So long as video entertainment is not financed primarily by government taxation, as it has been in many places outside the United States, such costly ventures as have been suggested are not likely to materialize.

What the military consultant and telco personnel may have in mind is that federal taxes would be used to support the capital expenditure for the LEO satellite network in the furtherance of national security, broadly defined. As a by-product, the network could be used to deliver video entertainment of quality and quantity beyond cable TV's wildest dreams, supported by both subscription fees and advertising. Capital and operating costs could be allocated between national security and commercial usage such that the prices charged to consumers and advertisers could be competitive, if not actually predatory.

Programming

Programming for 50 channels was once considered impossible; now we see a potential need for 150. Could even demand access, or near video-on-demand, reasonably utilize as many as 1,000 or 2,000 satellite relayed channels? Is there viable programming support for such capability?

How long would it take to replace 200 million VSB/AM NTSC TV sets, or provide the necessary interface adapters to receive the digital transmissions from the LEO satellites? How much would they cost? How much would it cost for a steerable antenna to track the LEO satellites and handoff from one to the next as it passes overhead? How about MDUs? Would the look angle be high enough to clear foliage, structures, or terrain obstacles? How about rain fades? How much transponder power is required for reception by a very small aperture antenna?

No end in sight

It could happen. Reality has been known to outstrip even science fiction. But predictions of the demise of terrestrial broadcasting and some form of cable TV are assuredly premature. As Mark Twain said in his 1897 cable from London to the Associated Press: "The reports of my death are greatly exaggerated."

Unless cable TV buries its head in the sand, it will be around for a long time to come. **CED**

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

**For a description of Iridium and Project 21, see article by Lawrence W. Lockwood in* Communications Technology, *February 1992, page 74.*

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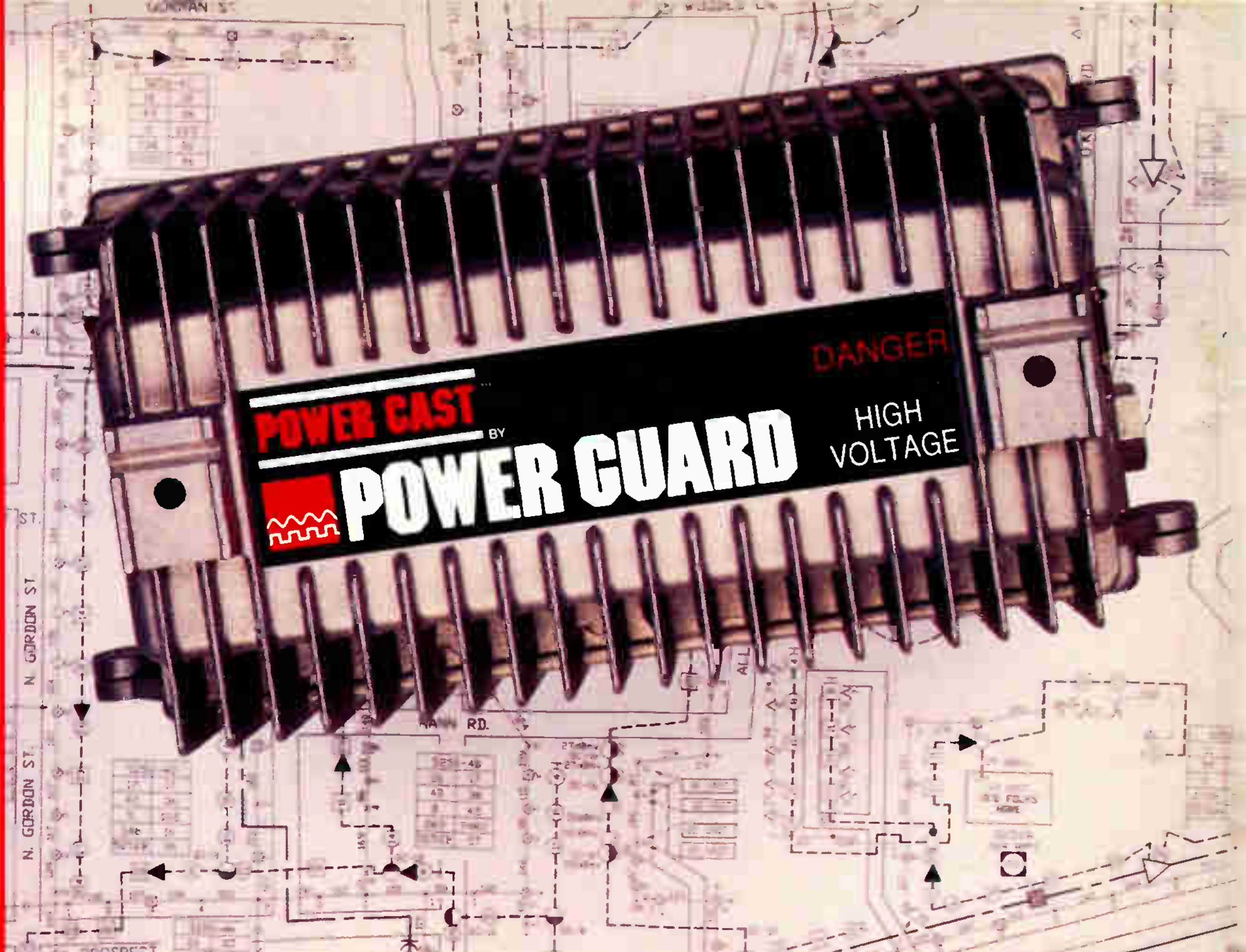

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