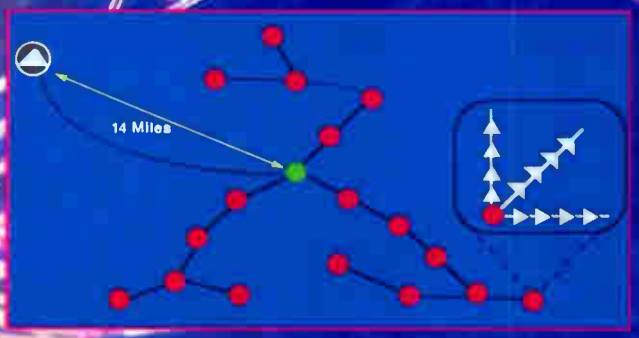
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

Fiber optics

- Testing FTTH
- AM supertrunking
- Promoting the benefits



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Western Cable Show wrap-up

January 1992

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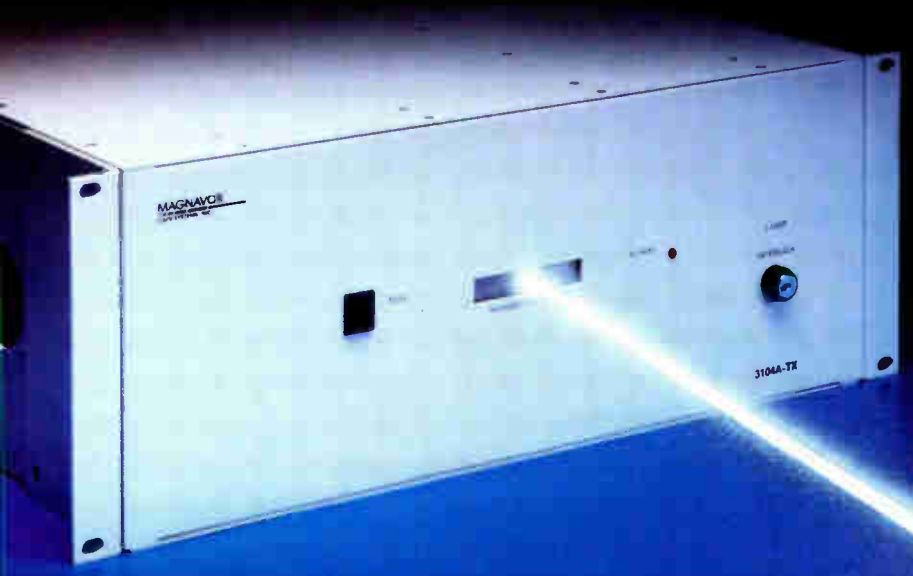

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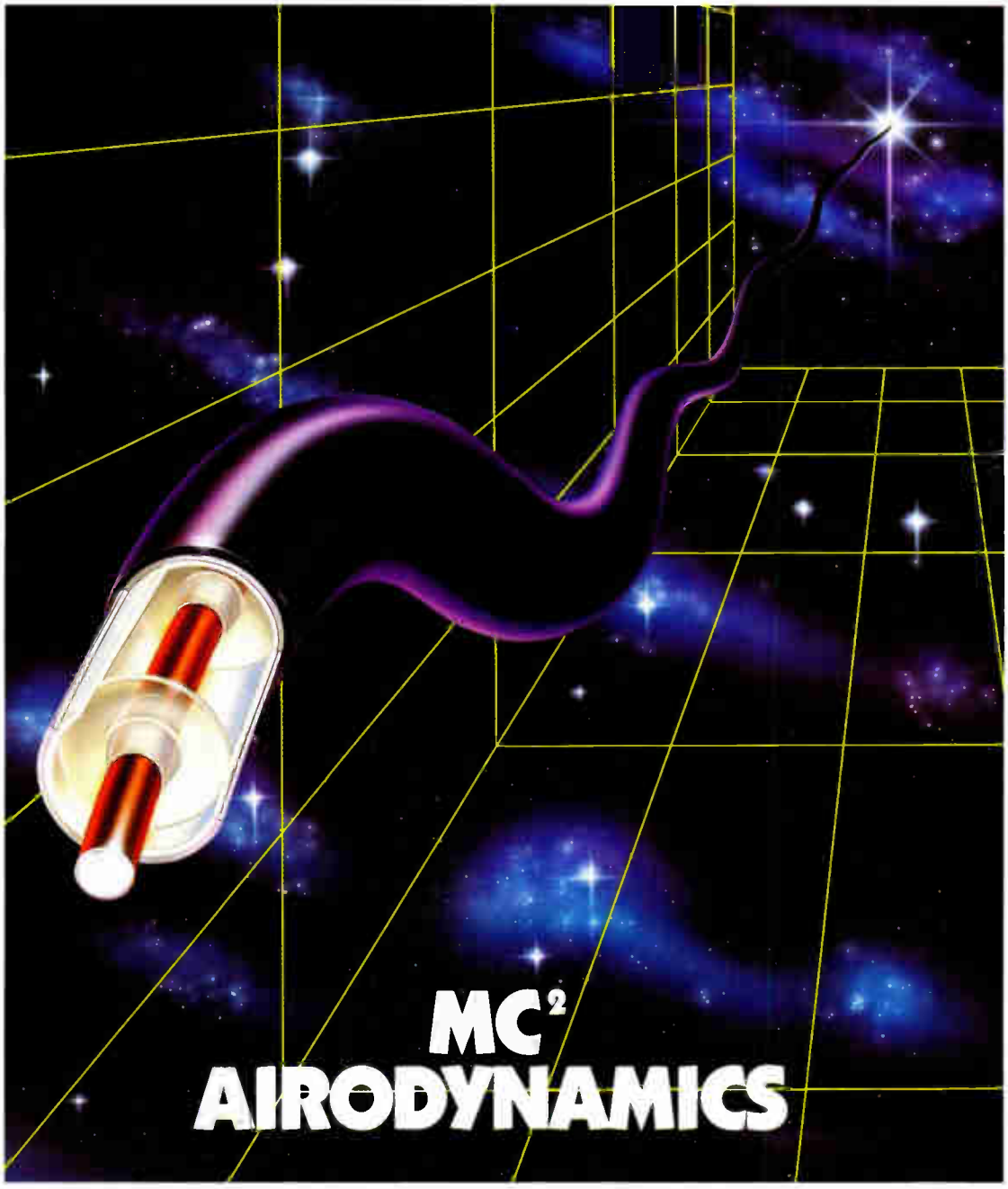

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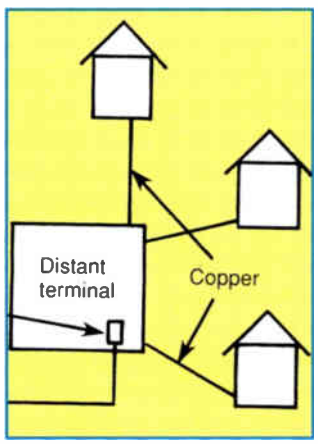


Features

ONI OPTICAL NETWORKS INTERNATIONAL

Optical Network News

A technology newsletter for the cable industry.

Jokerst recommends taking action today

With the myriad of technologies available to cable operators today, bold decisions must be made to step forward with implementation, rather than waiting to see what developments are down the road. Tom Jokerst, of Cable Labs, recommends "a migration strategy that integrates today's options with tomorrow's choices and business needs." This will allow operators to reap immediate benefits from today's tools instead of waiting for a final, all-encompassing solution. (See related story in the winter 1991 issue of ONN.)

Digital technology around the corner

Many cable operators are building the foundation for digital services as they deploy fiber further into today's cable systems. With an eye to revenues from video-on-demand, interactive entertainment and information services, cable networks are now being designed for digital compression and transmission capabilities. (See related story in the summer 1991 issue of ONN.)

CISN: A plan for analog to digital migration

The Cable Integrated Services Network (CISN) is a plan developed by AT&T and ONI to integrate analog and digital video, PCN, voice and data services and interactivity within the cable television network infrastructure. CISN offers a spectrum utilization plan that incorporates video compression and analog transmission techniques in a 1 GHz spectrum, and provides for a flexible migration from analog to digital transmission as the market for new service develops. (See related story in the winter 1991 issue of ONN.)

Alternate access provides for immediate opportunity

Alternate access is the connection of two end users via facilities other than those provided by the local exchange network (i.e., RBOC). With the capacity cable operators are now adding to their networks through fiber optics, alternate access provides immediate opportunity for those operators ready to expand their revenue base now. (See related story in the summer 1991 issue of ONN.)

EDITOR'S LETTER

Our low tech image

I'm overseas again as I pen this editorial, inspired by comments from one of the other speakers at an international conference I participated in a few days ago. It seems that cable TV in America has an image problem, and this time it isn't about high rates or customer service problems. It's about the technical standards of U.S. cable compared to the standards in this other speaker's home country. I recognize that our industry does in fact have an image problem, and this seems to further substantiate it.

During his presentation, he commented on the very high technical standards for CATV that the German Bundespost has in place, and stated that they were substantially superior — by a factor of 10 dB or so — to the standards of the U.S. cable industry. My first reaction was about to be one of typical nationalistic pride, but after further reflection I realized that his knowledge of our so-called standards was very likely based on old information.

The only standards we've had for system technical performance have been the FCC rules. Unfortunately, with the exception of signal leakage requirements, the U.S. cable industry has had no technical regulations with teeth for some time now. If you'll recall, the bulk of the commission's technical standards in Part 76 were "demoted" to guidelines several years ago. That will change, of course, with the adoption sometime in the next several months of new and tougher technical performance requirements.

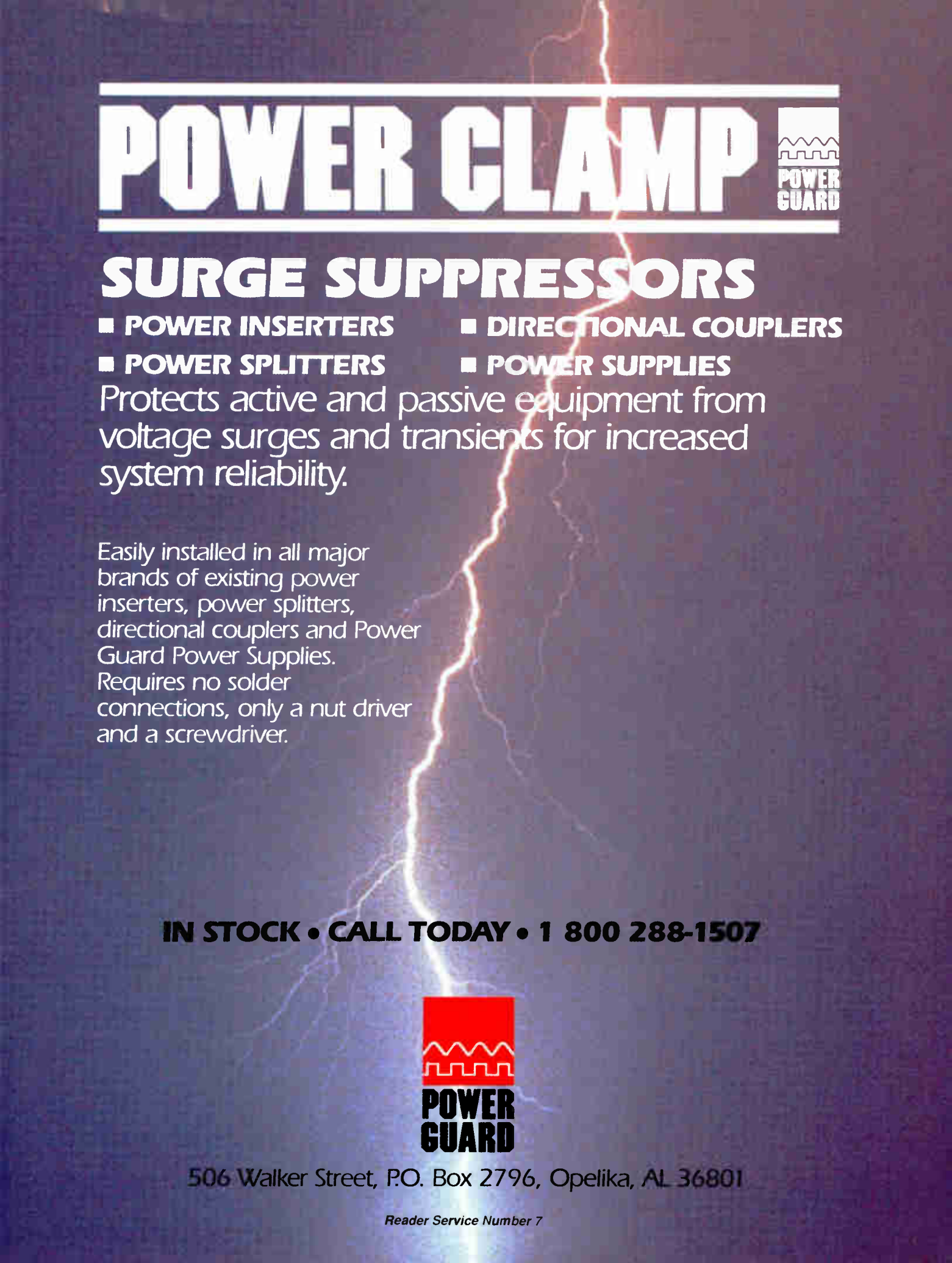
But think about the old rules: Specifications like 36 dB carrier-to-noise were typical. If we attempted to sell pictures with a 36 dB C/N ratio to our subscribers, we'd be run out of town. That doesn't mean that there haven't been a few operators who've tried, but most of us have more sense than that.

Thank goodness a number of more reasonable technical guidelines have been recommended by NCTA and most of our major manufacturers. Many of the top MSOs have company standards that are based on sound engineering practice. Ten years ago, when Al Kernes was Jones Intercable's corporate engineering vice president, he set company specs that were high even by today's thinking. How do 47 dB C/N and -52 dB CTB sound (and this was a decade ago)? Those numbers were tough to meet, but it was possible.

Which brings me back to my original line of thought. Our industry's image apparently needs some work. If engineers in other countries think that the old rules are indeed our technical standards, and that they also are typical of the performance of U.S. cable systems (probably because of pictures seen in some hotel), how do we go about changing that image? With the soon-to-be new rules?

Quite frankly, I'm not particularly impressed with the proposed new regulations, either. They are certainly much better than what we had before, but I think there's still room for improvement. Oh sure, some in the industry have complained about the rebuilds and upgrades that will be necessary to make systems comply with the specifications that have been discussed over the last several months. But are the cable systems in our country really that bad? If so, then maybe my German colleague was more accurate than I gave him credit for.

Ronald J. Hranac
Senior Technical Editor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LETTERS TO THE EDITOR

What's in a title?

This is an open letter to the Society of Cable Television Engineers membership.

Sometime this month or in February you will receive a ballot requesting your vote for or against a change in our bylaws. Among other things, the proposed change would make the present executive vice president the president of our SCTE.

I think most every member agrees that the efforts of our executive vice president, Bill Riker, have aided the growth of our society. With his dedication and the help of his staff he has provided informative and well-orchestrated conferences, and our Cable-Tec Expo has only got better with each passing year.

The issue, however, is whether we should change the title of his office to president. What are the duties of executive vice president? They are to execute the will of the board of directors in accordance with the Society's bylaws. In this endeavor, Bill has excelled and as a paid employee of the SCTE with a bonus plan, we expect no less of him.

What benefits will the Society gain by this title change? Some stated reasons are: 1) "It will be easier to negotiate with properties (hotels) when setting up conferences." and 2) The National Cable Television Association operates this way."

Here is why this director believes the position of executive vice president should *not* be changed to president, nor should our existing positions of president and eastern and western vice presidents to be changed to "chairperson" and "eastern and western vice chairpersons."

First, negotiations with properties is a non-issue. Bill has done an excellent job. Second, the NCTA is a political organization. Other engineering-based organizations operate the way ours does. More importantly, I believe that the position of president of our Society should be an elected one, not an appointed one that can't be changed without a firing or another alteration of the bylaws.

I also believe the position and duties of executive vice president do not qualify for the title of president. The two dictionaries I consulted define president as "a person elected to preside over an organization ... the chief officer of a bank, company, corporation, etc." and "the highest officer of a company, society, university, club, etc." These explanations certainly represent our existing office of president, but fall short of specifying the office or duties of our executive vice president.

In contrast, "chairman" is defined as "the presiding officer of an assembly, committee, etc." but the entry says nothing about the chairman being elected or holding a position of stature in an organization. Does "chairperson" sound like the title we want to bestow on the individual who holds the highest office in our organization?

Finally, if the membership becomes dissatisfied with the direction of the Society under the present bylaws, it can change its presidency by not re-electing to the board the person holding that office. Under the proposed change to the bylaws, this option is lost. I urge to mark your ballot "No."

Richard G. Covell
SCTE Director-at-Large

Editor's note: For more on the proposed titles, see "SCTE News" on page 20 and "President's Message" on page 102.

NEWS

Personal communication services: FCC admits huge task, opportunity

WASHINGTON, D.C. — With numbers like $70 billion in the potential personal communication services market being tossed around, the "industrial opportunity" (not "industrial policy") question for the FCC at its *en banc* hearing in December was not "if," but "how" to get there. And, given the consensus that the opportunity exists — because, for the first time in a while, untapped market demand may be ahead of technology and certainly is ahead of federal/state regulation and spectrum management — everyone seemed to be in a hurry.

Haunting the commissioners as they pondered their responsibilities with regard to possible pre-emptions, standards, spectrum shifts, and user relocation were regrettable lessons learned from the likes of NTSC, color and protracted cellular deliberations. But eager to help the FCC with the task were, of course, executives, engineers and consultants with leading communications, technology and R&D firms. The point driven home the most was that PCS represents a whole *family* of products and services from low to very high functionality, priced accordingly. Craig McCaw of McCaw Cellular pressed for full integration of services to bring about a single multipurpose handset, advocated seamless coverage and strongly warned against spectrum set-asides or preferential treatment for telcos or any industry sector. Central among the issues discussed were fundamental characteristics of economic and technology infrastructures needed to support such services.

ATC's Jim Chiddix, on behalf of CableLabs, emphasized the cable industry's evolution to an interactive "star" network capable of supporting virtually any communications service consumers demand. Chiddix said hybrid fiber/coax systems being built may provide the ideal interconnection infrastructure for PCS. Among barriers to PCS could be small cell size and cost of electronics within each cell. "The fiber/coax cable network can solve both problems," Chiddix said. "Through frequency reuse, cable's broadband capacity can satisfy the interconnection needs of a microcellular system, almost as a byproduct of a network build to cable's entertainment business."

Telco execs offered parallel arguments. And former FCC Chairman Dennis Patrick, CEO of Time Warner Telecommunications, called for open licensing; said if preference is given at all it should be given to cable; and said transferring of rights should not be prohibited. The issue of the potential for "huge auctions" for frequency shifts had been raised throughout the day. And commissioners grumbled aloud whether their 6 MHz transitional allocation for broadcast HDTV was wrong. The next step is consideration of mission and makeup of a PCS advisory committee.

SCTE holds first EBS meeting

ANAHEIM, Calif. — If the importance placed on the Emergency Broadcast System by President Bush since the Persian Gulf War has you wondering just how cable TV can have a definitive role in EBS, there's a Society of Cable Television Engineers subcommittee forming right now that you should know about.

The inaugural meeting of the SCTE's tentatively titled Public Safety Engineering Subcommittee was held at the Western Show and has taken as its immediate focus CATV's integration of EBS.

SCTE Engineering Committee Chairman Tom Elliot said a chairman and working group chairmen are being actively sought for the subcommittee. Membership is open to anyone interested in the industry's development of recommended practices and procedures for CATV public safety engineering (immediately EBS). For more details you can contact Wendell Woody, SCTE president, c/o SCTE, 669 Exton Commons, Exton, Pa. 19341, (215) 363-6888.

At the meeting Woody noted that the ultimate goal of this subcommittee could be developing a voluntary and functional system and forming design and application standards. The FCC's interest in CATV EBS participation on a large scale was apparent at the first meeting as John Wong, Richard Smith and William Browning (all of the FCC) praised the formation of the subcommittee as showing cable wants to make a sincere effort to be involved in EBS. Browning, chief of EBS at the FCC, shared his hopes that 25 percent of cable operators would be participating in 1992, 50 percent in 1993, and 85 percent in 1994. Smith quelled rumors that perhaps the commission would consider forcing EBS regulations on cable if the industry didn't voluntarily get involved by saying that he didn't see that as necessary. He noted that the CATV industry is aware it needs to play a larger role in keeping the public informed of emergencies, and the formation of the subcommittee just reiterated the industry's sincerity in getting involved.

S-A joins ATV team, makes large set-top sale

NEW YORK and ATLANTA — Scientific-Atlanta joined with Zenith Electronics and AT&T to pursue advanced TV (ATV) technologies. The companies said they will team together to support the selection of the Zenith/AT&T Digital Spectrum Compatible HDTV (DSC-HDTV) system as the U.S. HDTV standard by the FCC. S-A is to develop the necessary transmission and conditional access system and equipment to allow secure satellite transmission of the DSC-HDTV signal to make HDTV programming available to all markets and to support a timely market introduction, according to the company. As well, S-A will contribute to testing of the system over satellite.

Under a separate agreement, Zenith and S-A said they have developed a common transmission structure for carrying the Zenith/AT&T DSC-HDTV signal and S-A's digitally compressed standard TV signal through cable plants to the home. Additionally, S-A (supported by Zenith) submitted a proposal to CableLabs, TCI, Viacom and PBS to develop a system for compressing multiple standard NTSC signals into a single channel for both satellite and cable transmissions. The new digital program delivery system will incorporate the compatible transmission of both Zenith/AT&T DSC-HDTV and VQ digitally compressed standard TV using the Zenith four-level

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VSB modulation. Furthermore, S-A and Zenith also submitted a joint proposal to HBO for the same type of digital program delivery system.

In more S-A news, Scripps Howard Cable ordered more than 300,000 of the company's Model 8600 set-top terminals for delivery over the next four years. Terms of the order weren't disclosed.

SCTE sponsors show tech sessions

ANAHEIM, Calif. — The Society of Cable Television Engineers sponsored several technical sessions at the Western Show. The following is a synopsis of those sessions:

• *AM fiber* — "AM fiber-optic technology in practice" was a discussion of actual experiences with AM fiber-optic systems by operators presently utilizing this technology, moderated by Mark Harrigan of TCI of California. Michael Mead detailed the AM fiber-optic rebuild in Continental Cablevision's Stockton, Calif., system, including what equipment was chosen and the fiber-to-the-feeder design used. Benefits included improved technical performance, greater bandwidth and improved reliability. Dave Spallinger, also from Continental, reviewed implementation options and gave a brief history of what one Florida system had been exposed to as far as AM fiber optics. He stressed that operators looking at implementing this technology should look to the suppliers for assistance. TCI's Patrick Kelly revealed how to "take the fear out of fiber optics." Areas to focus on are understanding fiber optics, defining objectives, walkouts, design, construction, splicing, mapping, documentation and restoration. Mike Campbell of Viacom discussed cascade reduction in its Pittsburgh, Calif., system. He highlighted the changes in the system from 1968 to 1991 and the equipment chosen.

• *ATV* — Western Show attendees got the latest report on just what's happening in advanced TV testing at the Advanced Television Test Center and heard specific results on the two systems that have completed the testing process there.

Moderator Tom Elliott of Catel kicked off the "Advanced television systems testing progress report" technical session by introducing Peter Fannon of the ATTC. Fannon compared the Japanese, European and U.S. approach to ATV and specified the goals of U.S. activity. These included developing a single standard, creating national interest, spawning international trade for the United States, and interfacing with other high definition users. He pointed out that an ATV standard must be rugged, benign, quality and practical. Brian James, director of ATV testing for Cable Television Laboratories, described the subjective nature of ATV testing and noted they require expert observers to make decisions. He also explained the various tests run on the proposed systems.

The David Sarnoff Research Center's Scott Keneman reported on the results of the center's Advanced Compatible Television system and noted its noise immunity circuits in hardware and picture improvements (including 16:9 image quality improvements). The NHK Narrow MUSE system was explained by the company's Keiichi Kubota, including the fact that it is not all analog as some people have thought, but a combination of proven analog technology and some digital. He touted its benefits as its soon-to-be availability, its compatibility with other media and the fact that it is less expensive. →

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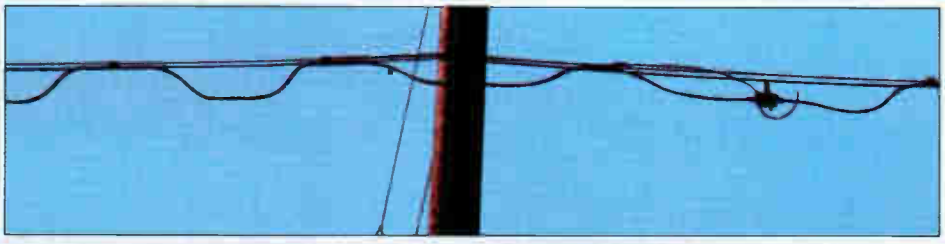

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• *Digital compression* — The "Digital compression" session moderated by Continental's Terry Mast provided an overview of digital transmission over cable distribution plant plus the technology and timetable for compression.

Richard Prodan of CableLabs began by covering digital modulation field evaluation for CATV, including typical modulation schemes and ways to do spectral shaping. He said that CableLabs plans to evaluate strengths and weaknesses of modulation techniques. AT&T Bell Labs' Carl McGrath discussed digital program delivery, highlighting advantages and problems, issues to think about, and realities, opportunities and expectations for the future. Scientific-Atlanta's Allen Ecker spoke about challenges in implementing digital video compression including how to solve migration from analog to digital and the different system architectures. He also examined critical issues in applying video compression from headend to subscriber and HDTV compatibility. Matt Miller of Jerrold focused on DigiCipher's strengths, technology, compression and HDTV system.

• *FCC update* — An overview of current regulatory issues facing the cable industry was provided in the "FCC/Washington update" session moderated by SCTE's Bill Riker. Richard Smith of the FCC began by urging cable to get involved in the Emergency Broadcast System. (See related story on page 10.) He noted that there are two Notice of Inquiries out related to EBS. The first deals with the need to update technical standards (comments were due Dec. 31) and the second involves shortening the tone (comments are due Feb. 28). Smith also touched on two areas the commission feels of import: signal leakage/CLI, and painting and lighting requirements for towers over 200 feet tall within five miles of an airport.

NCTA's Wendell Bailey gave a synopsis of issues before the FCC affecting cable. These include EBS, closed captioning, ATV, PCS, telco cross-ownership and technical standards. He cited the agreement on technical standards submitted to the FCC that was worked out between the cable industry and franchise authorities. Continuing in that same vein was Jonathan Kramer, a consultant representing the franchisors, who discussed the evolution of the agreement. FCC's John Wong said the joint agreement is worthy of serious review and that cable tech standards will be high on the commission's agenda in early '92; expect a decision by mid-year. Reiterating the FCC's focus on leakage, Wong said the 1991 CLI forms had only about 20 percent of the first year's problems. He ended by reminding the audience that the new rules for periscope-type antennas take effect April 1, 1992.

Attorney Steve Ross of Fletcher, Heald & Hildreth stressed the political arena cable is in and said that things like EBS involvement and the cities/cable tech agreement will bode well for cable in today's climate. The session ended with SCTE's Wendell Woody providing an update on Society events and programs, and the presentation of a plaque recognizing the elevation of the SCTE San Diego group to full chapter status.

• *PCNs* — The "Personal communications networks" session opened with moderator Roger Hay of CableLabs pointing out that although the definition of personal communications continues to evolve, there are some key elements identified: 1) mobility, 2) immediacy and 3) economy. Before turning over the mike to Jim Kearney of Malarkey-Taylor Associates, who gave an over-

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view of the possibilities of cable's role in personal communication services, Hay said there is a "richness of opportunity for cable" — only cable can provide the cell structure of PCS.

Alpha Resources' Tom Smith gave a presentation on RF propagation in microcells with the cell antenna collocated with the cable plant. He stressed concerns for the phase relationship between direct and reflected signals arriving at the mobile antenna, and discussed Cox Cable's planned PCN test in the San Diego area where cell sizes will likely range from 1/4 mile down to 1/10 mile. Andy Paff of Optical Networks International emphasized that although fiber optics has facilitated cable's interest in PCNs, coax will still play a major part. He also covered the PCS issues facing CATV: spectrum/regulatory, cost, credibility, timing and differentiation. The final speaker, C-COR's Jeff Sauter, pointed out that while many cable systems won't be putting in fiber right away, operators should consider upgrade/rebuild strategies with coax that plan for future services such as PCNs, near-video-on-demand, video-on-demand and HDTV. By employing a "neutral networking" approach, systems can be built using a non-directional RF trunking overlay today with the ability to accept fiber in the future.

Western Show notes

The following is a wrap-up of news announcements covered in the "CT Daily" at the 1991 Western Show held Nov. 20-22, in Anaheim, Calif. (Coverage of products introduced at the show begins on page 79.)

☛ Contec International presented a $1,000 check to the SCTE in support of the Society's Scholarship Assistance Fund at a luncheon sponsored by *Communications Technology* the day before the show started. The contribution represents the first installment on a $5,000 corporate pledge by Contec. As well, Contec announced an agreement to jointly establish a service center near Oak Communication's headquarters. (For the past seven years, Contec has been the exclusive warranty service organization for Oak.)

☛ Gilbert Engineering announced it acquired SAE (Societe D'Appareillages Electroniques), a connector manufacturer in Amboise, France. SAE supplies connectors for the French/European cable TV markets.

☛ Oak was part of several announcements released to the press at the show. Oak and Leitch Video International formed a marketing agreement in which the two companies have renewed their technology cross-licenses surrounding conditional access and encryption technology for Leitch's ViewGuard and Oak's ProGuard security systems. As well, Oak formed a strategic partnership with Concord, a group of internationally diversified enterprises headquartered in Denver and with offices in Washington, D.C., San Francisco, London, Hong Kong, Sydney, Australia, and Johannesburg, South Africa. Oak also announced the formation of a digital compression consortium that includes Oak, Leitch and C-Cube Microsystems. The consortium's system is based on system technologies (the MPEG compression standard, broadcast media interface standards) and implementation designs that minimize propriety technology and encourage multivendor sourcing. Finally, Oak said it reached an agreement with GTE for an initial order of 50,000 interactive home terminals to be used in GTE's new Main Street interactive cable service.

☛ Zenith announced it will manufacture 120,000 interactive Videoway ter-

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minals for distribution in the United Kingdom. The units allow access to videotex data bases, teletext, electronic messaging and downloading of computer software and video games via cable in addition to the addressable converter functions used for pay TV, movie selection and PPV.

☛ Antenna Technology recently installed one of its Simulsat 7 earth stations at Copley/Colony Harbor Cablevision, Wilmington, Calif.

☛ Optical Networks International announced an agreement with Falcon Cable for a complete upgrade of its systems in Coos Bay and Florence, Ore. ONI will supply 12 Laser Link II optical transmitters and receivers serving 30 node sites, as well as 42 sheath miles of AT&T LXE fiber.

☛ C-COR recently began regular shipments of its 1 GHz wideband distribution amplifiers to Time Warner for its interactive, 150-channel cable system being built in Queens, N.Y.

☛ All drop cable products from Times Fiber Communications are now standard with gigahertz bandwidth. Designated the T-10 drop cable series, these products complete the T-10 concept of standard gigahertz performance for all TFC cables at no premium price, according to the company.

☛ Tektronix Television Division announced a representative agreement with Jerry Conn Associates. The terms of the agreement call for JCA to market Tek's current and future CATV products to U.S. customers in the Mid-Atlantic and southeastern regions. This is the division's first such representative relationship.

☛ Continental Cablevision of Chicago bought a complete Cheetah status monitoring system with AML, distortion, Alpha power supply and HRC frequency monitoring, it was announced by Cheetah's manufacturer, Superior Electronics. Additionally, Superior said it has perfected its cellular communications from laptop computers to its family of monitoring devices. This is said to make communications more accessible by allowing access from vehicles or any remote area.

☛ Wavetek announced it established factory-direct CATV sales in California, Arizona and Nevada.

☛ TVC added 3M fiber-optic products to its line of CATV products. As well, TVC announced it was appointed primary distributor for Texscan MSI's character generator products in the CATV market. Under a non-exclusive arrangement, TVC will put its sales force to work in four market regions: Mid-Atlantic, Southeast, Texas and surrounding states, and California.

☛ Time Warner in New York purchased almost 100 of Leaming Industries' improved Model MTS-4 BTSC stereo generators. The units are for the system's near-video-on-demand PPV project.

☛ Coast CATV is now the West Coast distributor for Multilink, including its installation supplies like moldings, apartment boxes, etc. Additionally, Coast said it is the representative for Control Technology's standby power equipment for the West Coast including California, Arizona, Nevada, Michigan and Indiana.

☛ Sachs Communications announced the opening of its Southeastern Training Center in Cartersville, Ga. It is used to train operators on the use of Sachs hardware and installation techniques.

Clarification

In last month's issue of *CT*, the headline for Ripley's latest offering (page 71) may have resulted in some confusion between Ripley's product and the line of cable preparation tools from Ben Hughes. Ben Hughes holds a registered trademark on its use of cable prep. We apologize for our choice of words.

Title changes for Society's leadership receive board's nod

At its Nov. 19 meeting held in Anaheim, Calif., the board of directors of the Society of Cable Television Engineers voted overwhelmingly to recommend to the membership a bylaw change that would elevate the position of SCTE president to that of chairman of the board. The change also would mean that when the current position of Society president becomes known as chairman, the title of president will be used by SCTE's employed staff, elevating the current executive vice president to the position of president, and retaining the title of vice president to be used by the the employed staff when deemed appropriate. The new structure will also advance the current positions of eastern and western vice presidents to eastern and western vice chairmen.

The chairman's position will be elected by the national directors, each of whom represent his or her general membership constituents. The title of chairman is already used by many of the Society's 70 chapters and meeting groups in their organizational structures and bylaws, and at the national level the titles of chairman and vice chairman better reflect the actual positions of the elected board members who serve on a voluntary basis.

Citing similar actions already taken by the National Cable Television Association, Cable Television Laboratories Inc., Community Antenna Television Association, Cable Television Administration and Marketing Society, Amateur Radio Relay League and the California, Florida, Illinois, New England, Pennsylvania and Texas cable TV associations, this action gives the Society a more businesslike structure. The board recognizes the need for advancement due to the Society's continued growth in membership, increased national headquarters staff, international recognition and industry support.

"Being given the title of president has greatly enhanced my stature when dealing with organizations both within and outside our industry," commented Bill Arnold, who was elevated from executive director to president of the Texas Cable Television Association in 1984. "I have no doubt that his new title will enhance (current SCTE Executive Vice President) Bill Riker's ability to represent and negotiate better deals for the Society."

"The Pennsylvania Cable Television Association changed my title to president in 1987 after I had served the association for seven years," added PCTA President Stan Singer. "Considering the unprecedented success of SCTE during the eight years that Riker has been executive vice president for the Society, giving him the title of president should ensure a continuity of leadership to help SCTE continue its high level of service to the industry on through the '90s."

This referendum will be presented to the Society's membership during its annual election process to fill open seats on the board of directors. "This proposal represents changes in title only and does not affect the chain of command, responsibilities or representation by the membership," stated Region 12 Director Walt Ciciora, Ph.D., who first proposed the motion, which was seconded by NCTA Vice President of Science and Technology Wendell Bailey and Tele-Communications Inc.'s Tom Elliot. "It does, however, positively impact the chief paid staff member's ability to negotiate on behalf of the Society and I urge the membership to support the board in this change to keep pace with the Society's continuing growth," Ciciora added.

(Editor's note: For more on the proposed title changes, see "Letters to the Editor" on page 9 and "President's Message" on page 102.)

Texas Cable Show tech sessions announced

For the sixth consecutive year, SCTE is sponsoring the technical sessions for the Texas Cable Show, to be held Feb. 26-28 in San Antonio, Texas. Besides a variety of sessions on topics of vital importance to the cable TV industry, the Society also will present a Cable-Tec Games event, and examinations will be administered in its BCT/E and Installer certification programs.

The schedule for SCTE-sponsored events at the show is as follows:

Wednesday, Feb. 26

- Cable-Tec Games

Thursday, Feb. 27

- "Technical issues update," with moderator Bill Riker, SCTE, and speakers Wendell Bailey, National Cable Television Association, Tom Elliot, Tele-Communications Inc., Jonathan Kramer, Communications Support Commission, Dan Pike, Prime Cable Corp., and John Wong, Federal Communications Commission.
- "Technology explosion (session one)" — A focus on digital TV and CATV, 1 GHz cable systems, echo cancellations, ghost-killing systems and switched video over broadband cable TV systems, with moderator Wendell Woody, Antec Cable Group, and speakers Earl Langenburg, US West, Charles Merk, Magnavox CATV Systems, Steve Necessary, Regal Technologies Ltd., and Geoff Roman, Jerrold Communications.
- "Technology explosion (session two)" — A focus on the next generation of satellites, personal communications networks, evolving fiber-to-the-future and emerging technologies, with moderator Leslie Read, Sammons Communications, and speakers Richard Covell, Texscan, Bob Luff, Scientific-Atlanta, Colin Horton, C-COR, and John Vartanian, Home Box Office.

Friday, Feb. 28

- BCT/E and Installer certification testing

Retired membership available from Society

SCTE members who are planning to retire do not have to give up their SCTE membership. The Society's retired member grade is open to any member who wishes to continue membership following retirement from the cable industry. The status of senior or charter membership will not be affected by the change to retired classification.

The annual dues for a retired member are only $20, but membership benefits remain the same. Please contact (215) 363-6888 if you are at least 60 years of age, have been an SCTE member for the past 10 years and have retired from your full-time position. SCTE still needs and appreciates your support.

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Reader Service Number 17

Figure 1: Conventional architecture at 330 MHz

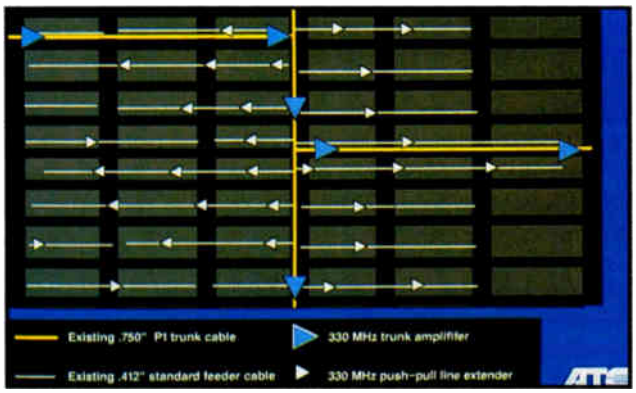
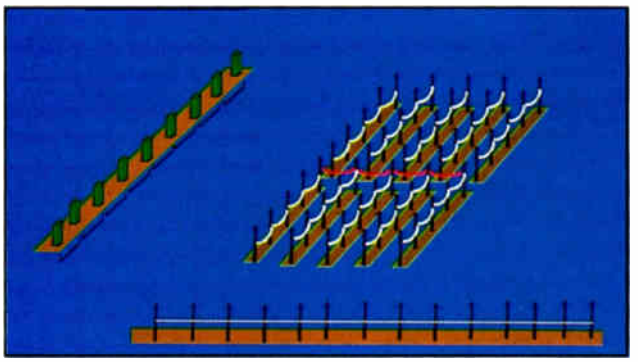


Figure 2: Three basic types of feeder line



Implementing hybrid fiber/coax upgrades

The following article is adapted from the paper "Cable communications network architectures," which ran in the "Society of Cable Television Engineers Cable-Tec Expo '91 Proceedings Manual: Collected Technical Papers."

Hybrid fiber/coaxial systems architectures, such as fiber-to-the-feeder (FTF), fiber backbone (FBB), cable area network (CAN), and super distribution have been frequently discussed in industry forums. This article will discuss ways to evaluate your current plant in preparation for a system upgrade and offer architecture alternatives that enhance the ability for a cost-effective subsequent upgrade. In addition, an example of intense fiber deployment is shown for a rural, low-density 550 MHz plant extension that offers a 15-20 percent cost savings over conventional approaches. The Time Warner Queens, N.Y., 1 GHz upgrade is touched on and a brief look at the evolution in 860 MHz European system architectures over the last 10 years is provided.

By Jay A. Vaughan
Senior Project Engineer
American Television & Communications Corp.

When developing an upgrade plan, it is useful to outline the primary objectives. Common objectives might include:

- Improved reliability,
- Improved picture quality,
- Simplified and lower cost plant maintenance,
- An evolutionary, cost-effective path toward a subsequent upgrade, and
- A solution that is cost-effective by today's standards.

In many cases, it will be difficult to find a single architecture to use in an upgrade that represents a cost-effective solution for all areas of the plant while meeting all of the objectives listed. Figure 1 shows an example of conventional 330 MHz plant. It is useful to categorize the plant into three major categories. These categories, shown in Figure 2, are:

1) Aerial plant, where existing multiple line extender feed-

Figure 3: Existing trunk and feeder cable

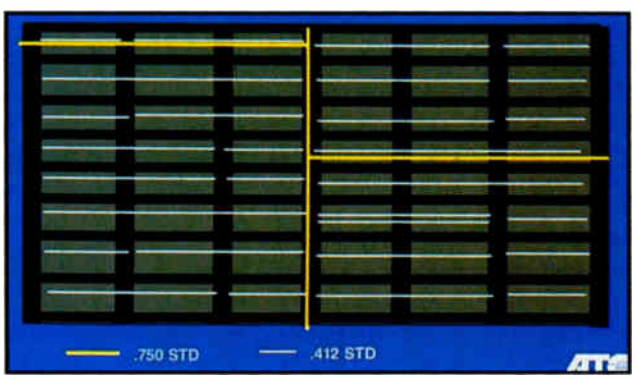


Figure 4: Single cascade high output level LE FTF architecture

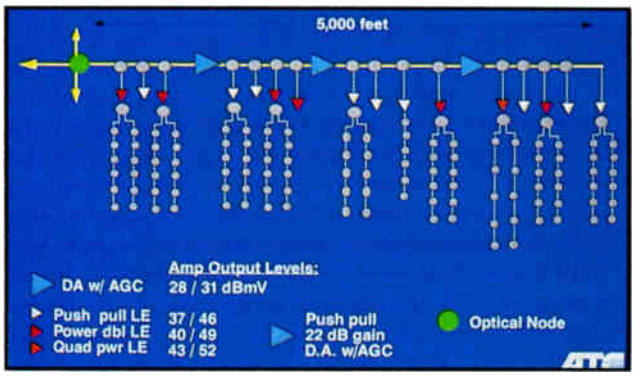


Figure 5: Single cascade high output LE FTF architecture at 550 MHz

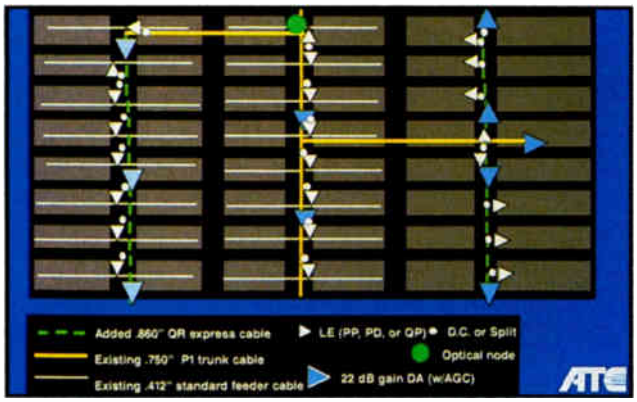
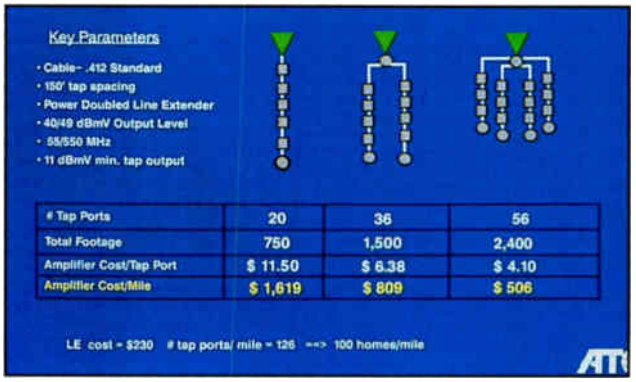


Figure 6: The benefits of output splitting



er lines could be broken into small pieces by adding modest amounts of additional cable.

2) Aerial plant where perpendicular access is not possible, thereby requiring significant amounts of added cable to break up existing multiple line extender cascades.

3) Long underground feeder lines, where perpendicular access is not cost-effective or possible.

In order to evaluate various architecture options, it may be useful to obtain several system prints showing only the cable that exists currently. (That is, without any actives or passives.) This assumes that the system maps are available on a CAD system that permits selective printing of system components. As an example, the system map shown in Figure 1, is shown in Figure 3 with all actives and passives removed.

By working with this type of print, the creative designer can lay out a totally new architecture since most of the reminders of the conventional architecture have been removed. The designer's focus, however, is to reuse the most valuable asset, the existing cable.

A schematic of a modified version of FTF architecture, similar to that being used in the Queens 1 GHz upgrade, is shown in Figure 4. This architecture offers a cost-effective solution that meets all of the previously defined upgrade objectives for distribution plant that falls in the first category.

An example of the architecture, applied to the same portion of the system contained in Figure 1, is shown in Figure 5.

How to pay for added cable

A common statement, in reaction to the architecture shown in Figures 4 and 5, is "That approach would be very costly because of the amount of added cable." In an upgrade, defined as a bandwidth expansion where most of the existing cable is reused, a significant portion of the total cost (after labor) is for electronics. This would include both line extenders (or distribution amplifiers — DAs — in an FTF upgrade) and trunk bridgers.

This architecture can be cost-effective for two primary reasons. One reason is that it features only a single high output level active (i.e., line extender) in cascade. This permits low technology amplifiers (e.g., push-pull) to be operated at high output levels. By lowering both the quantity and cost of feeder line electronics, the cumulative savings pay for adding significant amounts of cable. The other means by which this architecture can achieve cost-effectiveness relates to its aggressive use of output splitting at the line extender.

Figure 6 illustrates the added efficiency offered by output splitting, and therefore the reduction in feeder line electronics cost. Figure 7 compares the feeder line electronics' cost for a conventional upgrade with the alternative approach offered by this architecture. The savings in the latter of the two cases would pay for the amount of added

(Continued on page 42)

Figure 7: Feeder line electronics cost comparison at 550 MHz

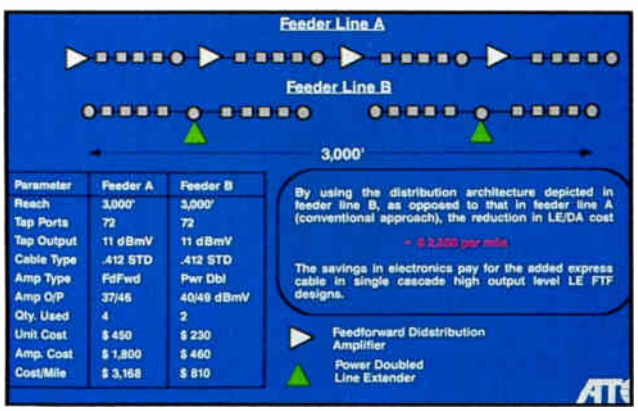
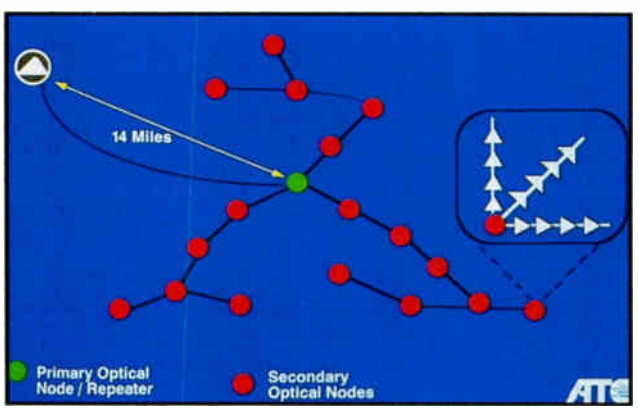


Figure 8: Low-density build using optical supertrunk



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Reader Service Number 18

AM fiber supertrunks: Point-to-point applications for multichannel video

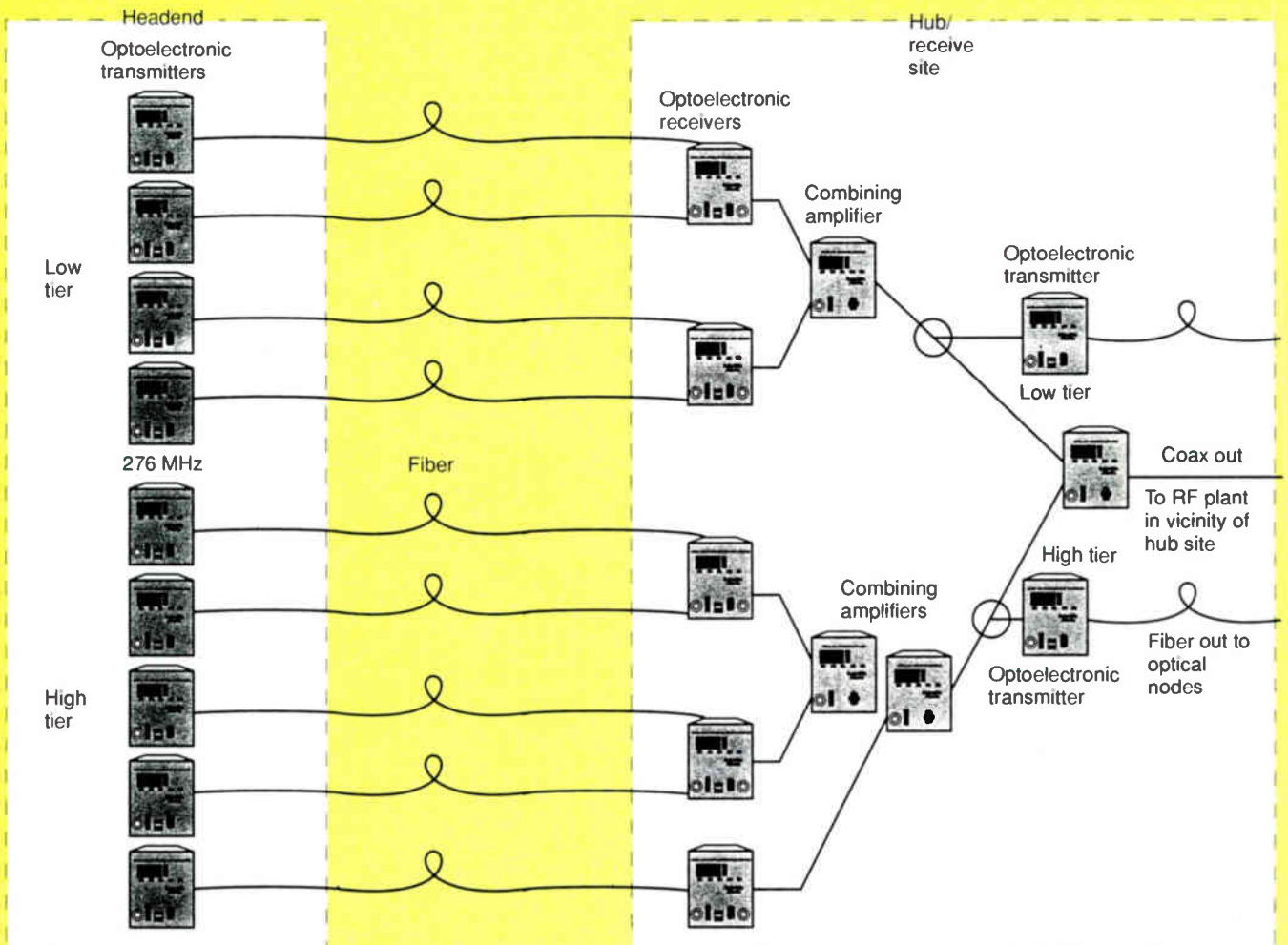
By Gary Lyons
Manager, Marketing Support
And Ron Hanson
Associate-Staff Applications Engineer
Scientific-Atlanta Inc.

During the last three years, implementing AM fiber technology into cable TV's distribution plant has been a major focus of a large percentage of cable engineers. The significant performance improvements of the distributed feedback laser (DFB) coupled with a reduction in prices has allowed AM fiber technology to move rapidly from the experimentation stage to almost total acceptance among cable operators. For most operators, multichannel amplitude modulated vestigial sideband (AM-VSB) laser transmission has become an integral "tool" in their toolbox of available, proven technologies.

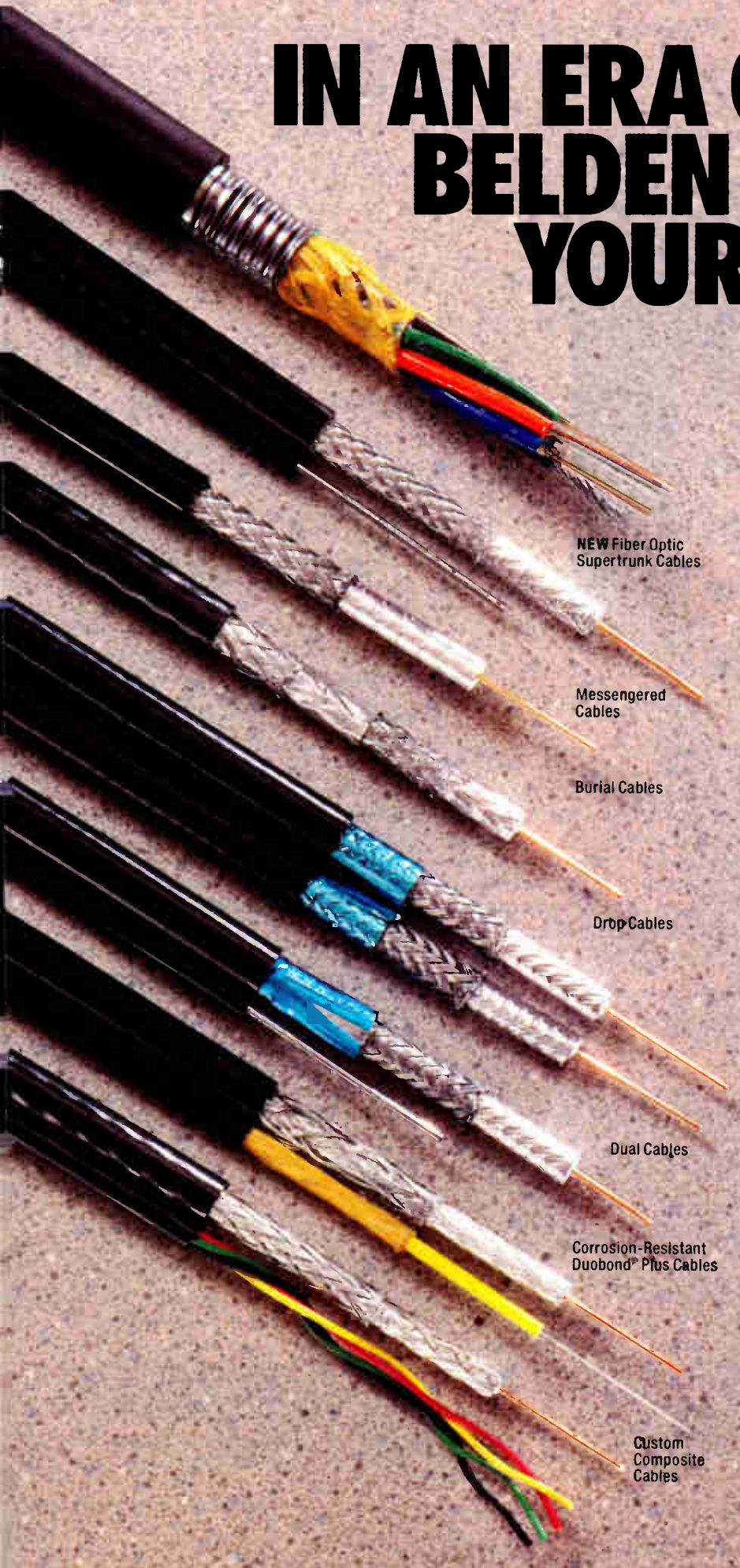
The outstanding performance results and superior reliability of AM fiber transmission equipment has led many operators and CATV equipment vendors to evaluate the technology for other possible applications. It is obvious that if all technology hurdles could be addressed, an operator would prefer to transmit programming exclusively in the AM-VSB mode. In many cases this would result in the elimination of signal conversion equipment (e.g., FM modulators and demodulators or analog-to-digital converters) and scramblers at hub (receive) sites.

Significant savings would be realized over the long run due to the reduction or elimination of certain recurring costs (e.g., real estate leases, equipment maintenance and power consumption) associated with

Figure 1: AM fiber supertrunk concept for 550 MHz



IN AN ERA OF LIMITS BELDEN EXPANDS YOUR OPTIONS.



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Reader Service Number 19

System requirements and testing for fiber-to-the-home

By J.J. Refi
Distinguished Member of the Technical Staff
And M.J. Swiderski
Member of the Technical Staff
Lightguide Systems Engineering
AT&T Bell Laboratories

Since 1988, several architectures have been proposed and implemented in fiber-to-the-home (FTTH) installations. These include the optical bus, the passive double star and the active double star. Each has distinct requirements that vary depending on the manufacturer's transmission equipment.

AT&T's FTTH feature of SLC Series 5 digital loop carrier uses an active double star architecture and currently provides up to four POTS (plain olds telephone service) channels per fiber. Additional channels and services, such as video, are being developed.

A fiber path can either extend all the way to the home, from a remote terminal (RT) to a distant terminal (DT) mounted on the side of a house, or from an RT to the curb with several DTs located in pedestals on the property lines. Operating bidirectionally over one single-mode fiber at an optical line rate of 1.544 Mb/s, the system can reach a carrier serving area of up to 12,000 feet from the RT. The current version provides the POTS channels at a 1,310 nanometer (nm) wavelength, while a future version will do the same at 780 nm.

With fiber runs between the RT and each DT, testing involves connecting to each fiber at the DT and at an interconnect cabinet in the RT. With this point-to-point topology, field testing methods and procedures become identical to those used in interoffice and loop feeder trunks.

Field tests on loop distribution fiber systems are frequently performed by construction technicians during, and immediately after, cable installation. The two types of field measurements most frequently performed are splice loss and end-to-end loss. Reflectance testing generally is not needed since there's a very low probability of failure when the route is constructed with quality components.

Figure 1: Far-end transmission and detection method for monitoring splice integrity

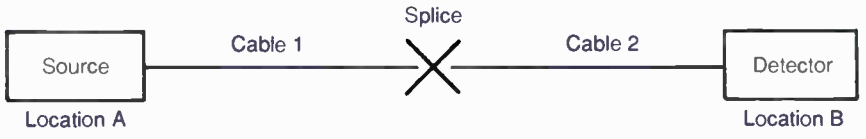


Figure 2: Local detection of transmitted power for monitoring splice continuity

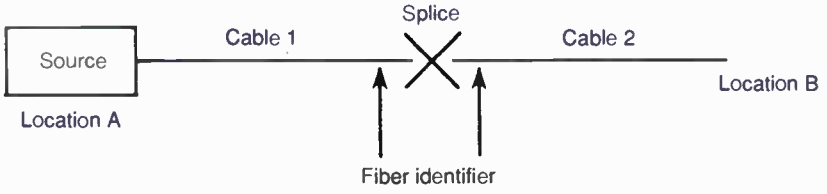
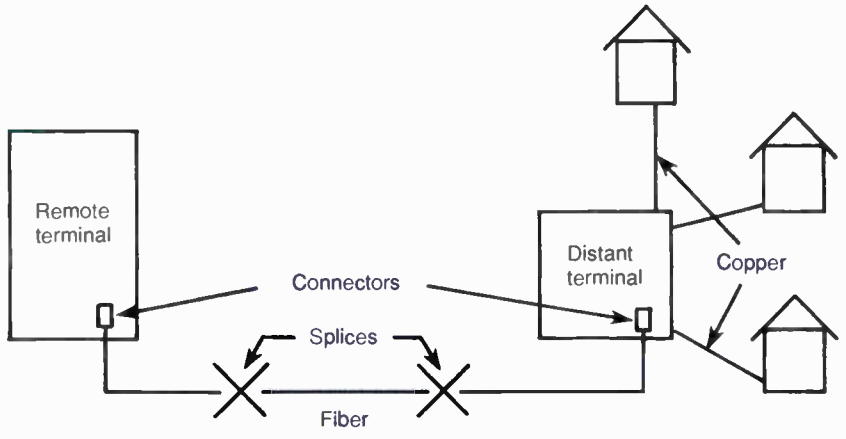


Figure 3: Measuring end-to-end loss between connectors in a point-to-point fiber-to-the-curb installation



Splice loss testing

Installation time can be reduced by making "blind" splices and not checking their quality. However, construction crews currently are reluctant to enclose splices in a splice case that might be encapsulated and buried without at least testing them first for splice continuity and, ideally, for splice loss. A variety of methods and equipment can be used.

• *Far-end transmission and detection.* The simplest way to monitor the integrity of a splice is to connect a light source to one end of the first cable and detect the signal at the opposite end of the spliced cable (Figure 1). This method for testing splices, however, is not widely used in FTTH installations. It requires a minimum of three people (one at each end and a third at the splice location) and communication paths among them.

(Continued on page 50)

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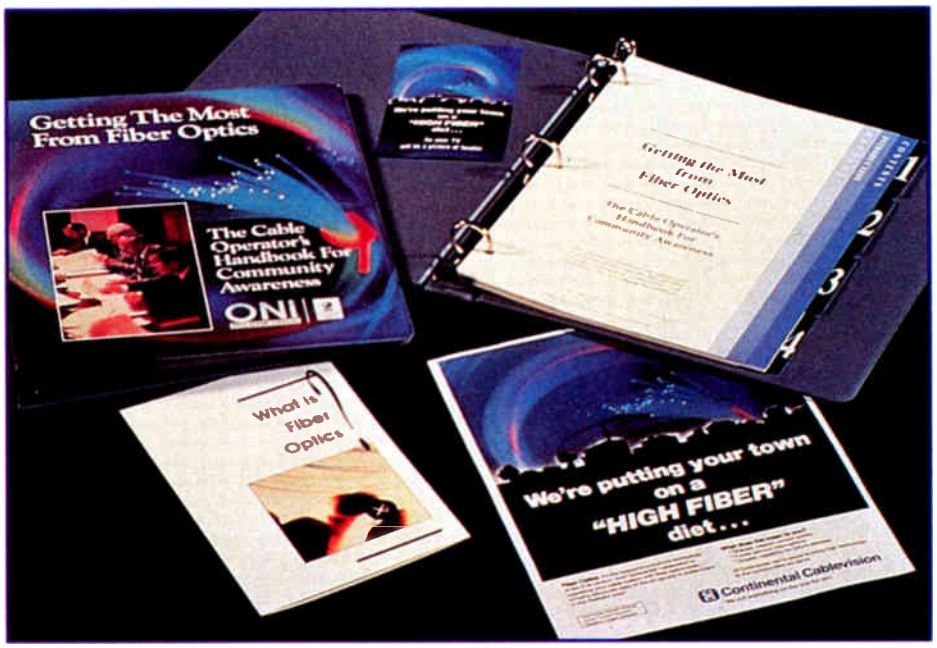
SIECOR

Using fiber to improve your system's public image

By Mike Sparkman
Vice President/Sales and Marketing
Optical Networks International



Materials that can help you get more public relations mileage from fiber-optic deployment.

Throughout the United States, cable TV operators are aggressively installing fiber-optic links to upgrade cable plants. Subscribers nationwide are enjoying the benefits of improved picture quality, expanded channel capacity and reduced service outages — all made possible by optical technology.

However, very few operators have taken advantage of the marketing and public relations value of the technology. In today's arena of cable bashing, along with dissatisfied customers insisting on better performance and service, it is necessary to promote the steps cable operators are taking to improve their systems. With increasing fiber-optic deployment, the technical community is in an excellent position to work with its marketing and public relations personnel to promote public understanding of the benefits of optical technology. Through this joint effort, cable operators can have a tremendous impact on the public's perception of the cable industry by simply informing and involving community leaders, state legislators and subscribers during the fiber upgrade process.

By working together, technical personnel also are better able to help non-technical personnel understand the power of the message they can get across — simply by defining and explaining the technical attributes of an optical system. Once armed with this knowledge, marketing personnel are better equipped to inform the local community.

Since many consumers already understand that fiber means pure signal quality, reliability and high technology, achieving the association between that understanding and the operator's deployment of fiber will reap image-enhancement benefits.

A desktop embedment commemorating a fiber launch can be given to local officials to promote goodwill.

An additional aid

To help inform consumers of the relationship between optical technology and cable TV, as well as provide a basic campaign outline for both marketing and technical personnel, ONI has designed a handbook specifically to help operators get the greatest possible public relations mileage out of their fiber upgrades. The guide is titled *Getting the Most from Fiber Optics; A Cable Operator's Handbook for Community Awareness.*

The handbook is presented in four sections that are applicable to any cable system wishing to inform consumers of the benefits of optical tech-

(Continued on page 57)

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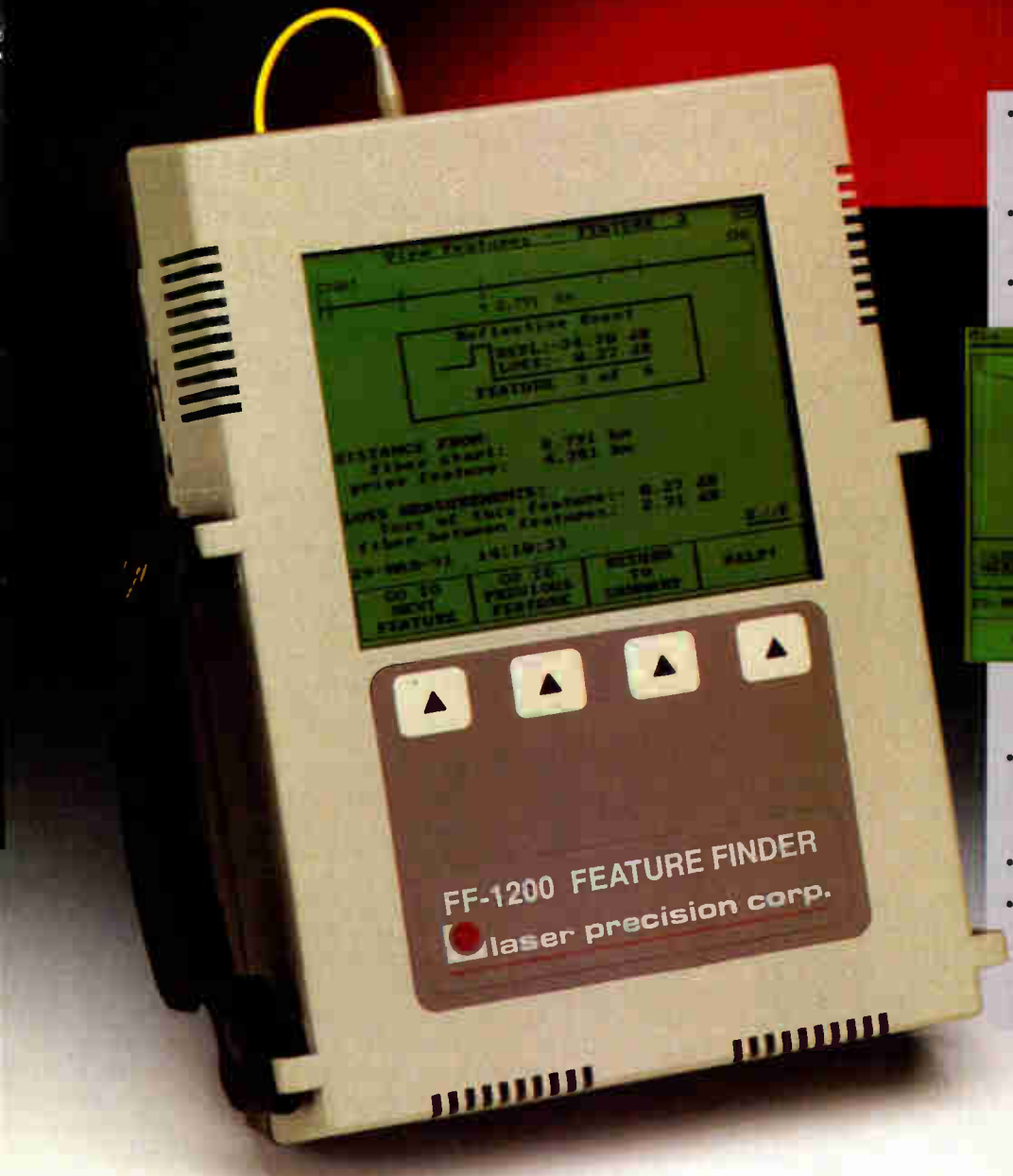

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Reader Service Number 22

Justifying high tech training in tough economic times

From the federal government to individual states and local municipalities, budget cuts are anticipated in the area of education. It would appear that many decision-makers have forgotten education is critical in a competitive world. Just as education is critical for the United States to compete as a leader in a global market, it is critical that cable TV operators focus on education to gain a competitive advantage. This is particularly true in high technology areas such as fiber optics.

This article reviews the advantages of training, including:

- *Employee retention.*
- *Maintaining construction/restoration teams with high tech skills.*
- *Competitive advantage of learning an evolving technology such as fiber optics.*
- *Continually improving efficiency by keeping abreast of technological advancements.*
- *Training used for certification purposes.*

In addition, this article will look at criteria to consider when selecting a training program. Criteria include a comparison of classroom and video-based training programs, amount of hands-on training, verifying instructor credentials, and the trainer's ability to custom-tailor courses and offer on-the-job training.

Hands-on training is an essential element of class curriculum.

By Rebecca S. Frye
Training Supervisor, Siecor Corp.

"Knowledge is power," Francis Bacon said nearly 400 years ago — and that statement has endured the test of time. In the high tech fiber-optics arena, trends and product technology change and improve regularly. This means cable TV's technical work force must keep abreast of advancements. It can be critical to know splicing and termination advancements that can save time and money, and planning tips to keep fiber-optic cable plant link loss budgets within their established range.

Training saves time, money

In addition to competitive advantages, proper training can improve the overall efficiency of employees. This efficiency can save time and money not only in the long run, but also for near-term needs such as emergency repair. For example, an emergency restoration team must be adept at operating optical test equipment, assembling mechanical splices and properly handling fiber. Team precision will help restore the system to full capacity quickly. Any time that the optical cable plant is down means no service to customers, and that can mean lost revenue for the system.

State-of-the-art fiber termination and splicing products are being introduced that simplify what was once considered very complex assembly procedures. For example, the average assembly time for an optical connector has dropped from 20 to 30 minutes to five minutes or less. Mechanical splices have eliminated fiber sizing and epoxies for simplified assembly. And fusion splicers are automated for ease and speed of splicing. That translates into efficiency and overall productivity advantages.

Many companies have seen employee retention and job efficiency improve when personnel were trained properly and regularly. Training breeds confidence, which empowers employees to do a better job. Employees who receive training in high technology skills are likely to remain loyal to their company and do a quality job. Skilled fiber construction and design personnel will become more in demand as fiber optics penetrates the cable systems of businesses and universities throughout the nation.

Advancements demand training

Fiber-optic technology has improved over the years, and many advancements have been made to simplify its use. Still, there is a skill level that must be achieved when working with fiber products. Proficient employees need up-front training and must practice their skills regularly to hone them and keep them fresh. For example, while optical cable is

(Continued on page 58)

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DMV

Reader Service Number 23

CATV dollars: Training offers the best bottom line return

By Ralph Haimowitz
Director of Training
Society of Cable Television Engineers

Every year those of us who are in management positions have to put together an annual operating budget. In today's business world there are few (if any) frills allowed, and the budget must be kept tight and adhered to during the operational year. We have learned to reduce our capital investments as well as our day-to-day expenses, and every day we are trying to find better ways to reduce operating costs and at the same time keep income growing.

Customer growth and service upgrades are largely accomplished through marketing campaigns designed to catch the customer's interest and create the desire to have the product. Our industry has been and continues to be highly successful in this area. Customer and service retention, however, has been a serious problem for years.

The problems with cable

Let's examine the most common causes of customer dissatisfaction that may result in a loss of customers or a reduction in program services, and some of the solutions that have been recommended.

Complaint: There are too many of the same programs, especially movies, when the customer subscribes to more than one premium service.

Answers: a) Market compatible services that complement each other and provide best for the customer's tastes. b) Provide more movies from the film industry and/or make more "made-for-cable" programming. c) Show customers the convenience and economy of cable premium services compared to the rental of videotapes or going out to the movies.

Complaint: Difficulty in calling the cable company when there is a customer problem. Phones are always busy.

Answer: Better training for CSRs so they can handle calls efficiently and answer incoming calls faster.

Complaint: Having to wait all day for an installer or service technician to show up.

Answers: a) Improve scheduling of installations for morning, afternoon and evening calls. b) Try to schedule a.m. and p.m. service calls. c) Stick to work schedules. d) Reduce the number of assigned work orders to a more manageable level.

Complaint: Poor picture quality.

Answers: a) Improve system through rebuilds and upgrades if needed. b) Provide better technical service.

Complaint: Cable company cannot seem to get the problems fixed the first time or the same problem recurs frequently.

Answer: Improve service.

Every single complaint listed has one common solution that will vastly improve the situation, and that solution is training.

Successful marketing is a direct result of the skills and abilities of the sales staff. Product knowledge, customer demographics, value packages, etc., are all acquired through quality training programs.

Training also plays a big part in the second complaint area for our CSRs who answer the telephones. They must learn how to handle the calls faster, respond quickly and correctly to customer complaints, and how to handle the difficult or time-consuming customer. They also need to be trained how to provide correct information and how to give intelligent, factual information to the customer.

In each of the last three complaints, training provides the greatest solutions to the problems. Installers who perform their jobs correctly because they are properly trained will produce quality work that results in installations that provide excellent pictures from the time of the completed installation through the next several years (unless some accident occurs that physically damages the installation itself).

Improper installations are a major cause of customer complaints and required service calls from problems that may take six months or more to develop. Here are some remarkable facts:

- A large number of installers in a northeastern state were enrolled in the Society of Cable Television Engineers installer certification course. To become fully certified the individuals must successfully complete a written examination and two job performance skill tests. All but 8 percent of those involved were considered to be experienced installers with at least six months of on-the-job (OJT) training and experience. Slightly more than half passed the written examination and 80 percent failed the drop cable preparation and fitting installation test. Remember that these were people who had received in-house training.
- Jones Intercable collected a vast amount of data just a few years ago that clearly showed the difference between those employees who had received OJT and those who were processed through their thorough installer training program. The number of install problems dropped dramatically, as did the number of service truck rolls to customers who were recent installs. The savings, companywide, were in the millions of dollars.

Although proper training is the key here, allowing sufficient time to perform the job correctly to prevent "costly shortcuts" caused by unrealistic time constraints is just as important. In addition to the tremendous savings in time and money that can be realized almost immediately, there is the value in customer satisfaction.

Complaints of poor picture quality and repeated service calls are frequently the result of inadequate training. It would shock most system managers to see the results of an accurate study within their system of how many drop connectors are replaced during routine trouble calls or how many times a customer's converter is changed out. This denotes a case of the technician not having adequate knowledge to make a proper determination of the exact cause or causes of the customer's problem.

The training tools

How can you determine if your

(Continued on page 60)

Certification for technicians: Skill-based pay

The cable TV industry is not experiencing the rapid growth it has had in the past. Associates are staying in their positions longer and looking for ways to advance within their own organization. Shifts in business strategies are necessary to respond to competition and service. Plans that improve quality, productivity and customer service are necessary elements in successful companies. A career plan and relevant technical training for all technical associates, coupled with a "skill-based pay" program, will provide a significant contribution toward a resolution. In this type of plan, associates are trained to do the quality work we expect and in return they are paid for their skills and knowledge and not just for coming to work.

But what does a "pay-for-knowledge" program entail and how can this relate to our industry's installers, service and maintenance technicians? This article will present an explanation of what skill-based pay is, explore the elements necessary to successfully execute the program and touch upon how it's been used.

By Pam Nobles
Senior Staff Engineer/Technical Training
Jones Intercable

Skill-based knowledge. Pay-for-knowledge. Pay-for-skills. Knowledge-based pay. Competency-based pay. These are all names for a system in which pay or salary is determined by the sets of skills that the person is capable of performing. In comparison, the "traditional" system (job-based pay) is a system in which pay or salary is determined by the job currently being performed.

The fact that it's been relatively easy to advance in the cable TV industry by "being at the right place at the right time" has always been a double-edged sword. It's usually good for the employee who was at the right place at the appointed time but companies are not getting what they need for success.

Under a skill-based pay program, specific skills are evaluated and pay is based primarily or entirely on skills, not seniority or other factors such as with a job-based pay plan. Pay increases are given after the skill is demonstrated, not when the associate's job changes. Advancement opportunities are much broader in skill-based pay systems.

According to Marc Wallace, professor of business at the University of Kentucky and an expert in the field of skill-based pay programs, there are six basic principles to consider for a successful pay-for-knowledge program:

1) *The pay rate should be simple.* Everyone should start at the same rate. The best should be hired up front through careful recruitment and by paying enough to attract quality people. The company then grows its own talent. Under this pay system the distance from the bottom to the top is relatively flat. The way to get ahead is to demonstrate competency in each skill block. There is an expectation of not doing the same job forever.
2) *The skill must be demonstrated.* Although written tests may be helpful (and in some cases necessary) the activity must be conducted and the results achieved must be performed successfully to represent what the associate actually knows.
3) *The point of economic efficiency would be to have all associates performing at the top of their level.* (However, I feel that provisions should be made to accommodate associates content in their position.)
4) *The move to the top should take two to four years.*
5) *Skill-based pay is based on 10 percent pay and 90 percent organization.*
6) *Review cost benefit.*

Benefits

Potential benefits to the company include higher quality, productivity and output, as well as lower turnover and reduced absenteeism. Labor/management relations are improved. It should be noted that productivity needs to be measurable. The company has to commit to and agree upon a measurement method.

Potential benefits to the associate include higher pay, better achievement of growth needs, and overall improved job satisfaction. The associate can actually see how he or she can move to higher pay levels.

There are four main elements that need to be explored to successfully execute the program: creation of a vision, design, implementation and follow-up. We will explore the first three.

Share the vision

If you don't know where you are going, you're probably not going to get there! Before people commit themselves to a common goal, there must be a clear, passionate vision of the desired future state of the company. This vision must come from and be supported by top management.

First, establish a reference measurement of where you are now, then set the goals of where you want to be. From here, the route should fall into place.

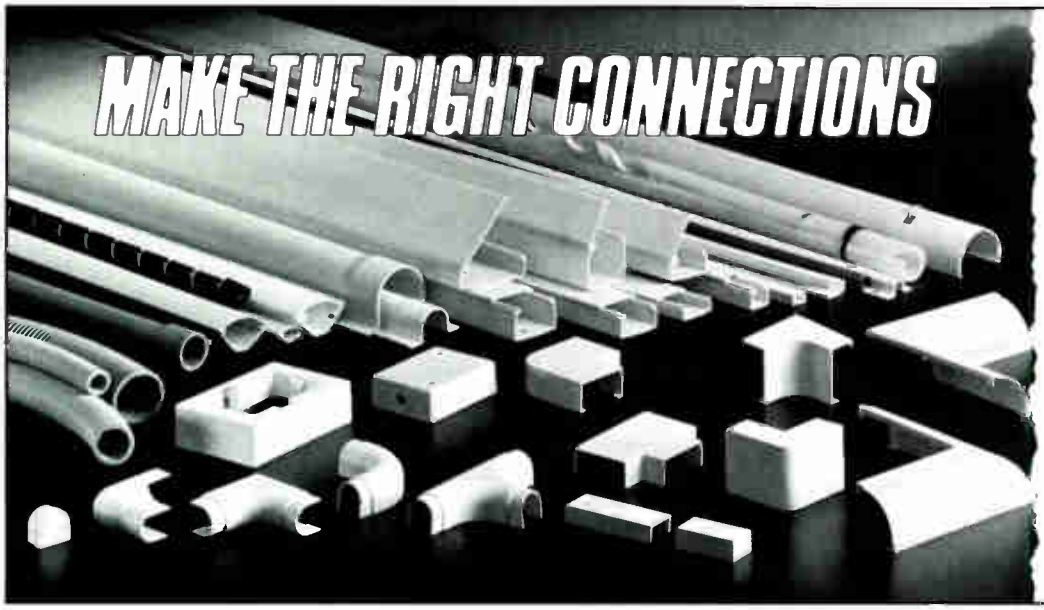
Key issues in design

Overall, the design of the program must fit with the technology and work flow that is unique to each organization. Decide which employee groups are covered under the skill-based pay program. For example, installers, service and maintenance technicians may be part of the program, but the supervisory group may not. Also, decide if work teams or groups would benefit your organization.

Associate involvement in plan design at all levels is critical. By gaining commitment and cooperation of associates at all levels, they have a sense of ownership and stake in pursuing the company's objectives and achieving company goals. Also, the associates chosen should be seen as leaders among their peers. However, it should be pointed out that to get totally candid input from your associates, it may not be advantageous to have associates and their supervisors in the same meeting!

The design of your program also

(Continued on page 62)



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Hazardous chemicals in the workplace

By Roger Keith
Director of Seminars, National Cable Television Institute

Every year, thousands of American workers are exposed to hazardous chemicals or substances on the job. Current estimates indicate that there are more than 575,000 existing chemical products in use worldwide, many of which are industrial chemicals that pose a serious health problem to those who work with them or around them. In some cases, workers don't know that the chemicals or substances they are using are hazardous to their health.

Chemical exposure may cause or contribute to serious health problems, such as heart ailments, kidney and lung damage, sterility, cancer, blindness, burns, etc. Beyond direct health hazards, misuse of chemicals may result in fires, explosions and other serious accidents.

Because of the seriousness of these safety and health problems, and because many employers and employees know little or nothing about them, the Occupational Safety and Health Administration (OSHA), issued a rule in 1983 called "Hazard Communication" that applied to employers in the manufacturing sector of the industry. The scope of the rule was expanded in 1987 to include employers in the non-manufacturing sector, including cable TV. The basic goal of the standard is to ensure that employers and employees know about chemical hazards and how to protect themselves.

Hazardous chemicals defined

As amazing as it may sound, we are virtually surrounded by hazardous chemicals. Realistically, few of them pose a direct safety hazard as long as they are used and stored properly. Unfortunately, we take many of these chemicals for granted, and in so doing we are often careless in their use.

OSHA defines a hazardous chemical as "any chemical whose presence or use is a physical hazard or a health hazard." It defines health hazard as "a chemical for which there is significant evidence that acute or chronic health effects may occur in exposed employees."

The actual list of chemicals found in the typical cable TV system varies, although most would immediately think of the technician's work environment. In actuality, the office has as many, or more, hazardous chemicals as the field.

What the standard requires

There are five essential requirements for system compliance with the Hazard Communication Standard. They are described in detail in Title 29, Code of Federal Regulations, 1910.1200. They are:

1) Develop a written hazard communication program for your system.

2) Develop and maintain a list of all hazardous chemicals and substances stored or in use in your system.

3) Procure and maintain a material safety data sheet (MSDS) for each chemical on your list.

4) Label all hazardous chemical containers if they haven't been labeled by the manufacturer.

5) Train your employees to recognize the hazardous chemicals with which they come in contact.

These five requirements apply to all cable systems and all of their employees. Citations and penalties (like fines) are issued by OSHA for failure to comply with any or all of the requirements.

The written program

The written program is the key element of the written hazard communication requirement. It must include the following elements:

1) General company policy: A statement detailing how this policy will be administered, to whom it applies and who is responsible for ensuring compliance with OSHA standards.

2) List of hazardous chemicals: A list of all hazardous chemicals found in the system. This section also should identify the individual responsible for keeping the list current and making it available for employees to review.

3) Material safety data sheets: A statement explaining the need for the data sheets and how they are to be used. Also identified is the individual responsible for updating the sheets and where the MSDS folder will be kept.

4) Labels: A statement concerning the labeling system to be used (if needed) and identification of the responsible party who will ensure their use and accuracy.

5) Non-routine tasks: A statement concerning exposing employees to hazardous chemicals with which they don't normally work. This statement should detail the specialized training necessary and the use of personal protective equipment.

6) Training: A statement detailing how your system will train your employ-

(Continued on page 66)

Potentially hazardous chemicals

- Acids
- Adhesives
- Aerosols
- Asbestos
- Battery fluids
- Benzene
- Catalysts
- Caustics
- Cleaning agents
- Coal tar pitch
- Coatings
- Degreasing agents
- Detergents
- Dusts
- Etching agents
- Fiberglass
- Flammables
- Foaming resins
- Fuels
- Fungicides
- Gasoline
- Glues
- Greases
- Industrial oils
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Reader Service Number 26

Figure 9: Early 1980s European architecture

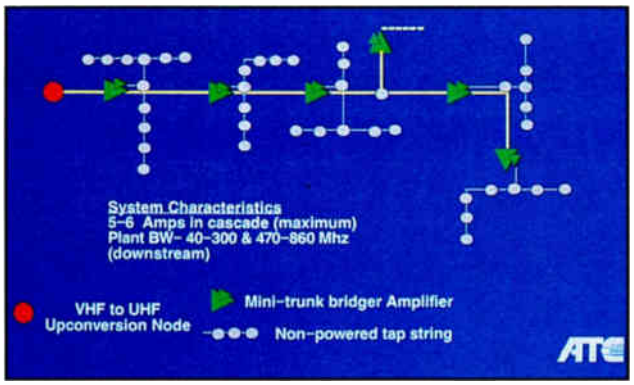
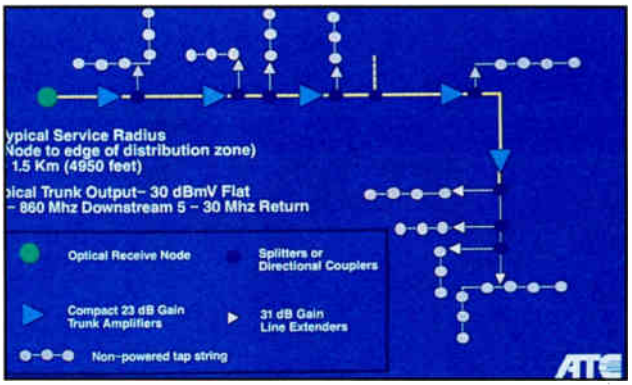


Figure 10: A common European architecture



Hybrid fiber/coax

(Continued from page 23)

cable required by this architecture. In the more classic FTF upgrade, the use of back feeding capitalizes on the added efficiency offered by output splitting of line extenders. The classic FTF approach is not limited to a single high output level device in cascade, which results in the frequent use of expensive, feedforward distribution amplifiers at an added cost. In addition, the amount of cable added for back feeding in the classic FTF upgrade approach may exceed the amount required for the alternative architecture outlined in Figure 4.

Cost savings for the optical system

Until recently, many of the AM fiber-optic links installed were part of a trunk amplifier cascade reduction project. These links are typically point-to-point. In a massive AM fiber link deployment, as a part of an FTF (or similar) upgrade, AM optical supertrunking may offer potential cost savings. In this case, an AM optical supertrunk could be defined as the first of two AM fiber links in cascade. At the primary optical node (the receiver at the end of the supertrunk) the signals are converted back to RF, which can feed a local distribution area if required, and in turn feed a second set of one or more AM optical transmitters (or repeaters). By using two AM optical links in series rather than one or more very long links, fiber-optic cable costs, and in most cases optical transmitters costs (as a result of optically splitting the transmitter for the secondary link) can be reduced.

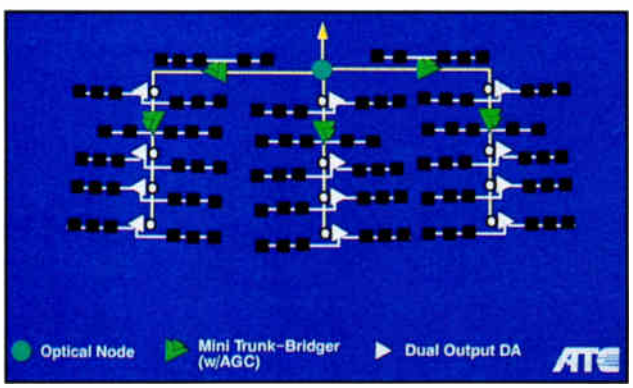
Thanks to the improved performance of today's AM optical equipment, the maximum path distance from the headend is potentially 35 miles when using two links in series. Even with this maximum path length, the performance at the output of the secondary node typically can be the same as that seen in 1989 with a 5-7 dB loss budget. A long-term disadvantage of AM optical supertrunking results from the reduced ability to narrowcast to each secondary node in the system. While this is probably not an issue today, it may impact future TV or telecommunications services. Given that surplus fibers are typically provided in many current installations, some options exist to overcome this hurdle when and if it arises.

Figure 8 (page 23) illustrates a low-density 550 MHz plant extension that is fed by an AM optical supertrunk. The supertrunk path is 14 miles, which is followed by three additional dual laser transmitters at the primary node. Each of the three transmitters at the primary node support a 13 dB loss budget and feed an average of five secondary nodes each. The coaxial plant that follows is essentially an FTF (tapped trunk) architecture utilizing four feedforward DAs in cascade. For the 60 cable-bearing strand mile area, the fiber/coax ratio (like a trunk/feeder ratio) is 1:2. The cost of approximately $13,000 per mile (which includes the cost of the 14-mile optical supertrunk) represents a savings of more than 15 percent when compared with more traditional architectures. This case serves to illustrate the price/performance ratio of AM optical links available today when used in an upgrade, rebuild or new-build project featuring aggressive fiber deployment.

European architecture evolution

In evaluating the architecture options for an expanded bandwidth system, it is useful to look at how European 860 MHz architectures have evolved over the last 10 years. Figure 9 shows an architecture that was built in France approximately 10 years ago. This approach strongly resembles the super distribution architecture. While all of these European systems were designed for channel loadings of 20 to 50 channels, the architecture comparison is valid since the cable attenuations and passive losses at 860 MHz are very close to those at 1 GHz. Since the performance of the amplifier technology used

Figure 11: Queens 1 GHz, 150-channel architecture (upgrade)



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Reader Service Number 27

"By using two AM optical links in series rather than one or more very long links, fiber-optic cable costs, and in most cases optical transmitters costs ... can be reduced."

(both discrete and hybrid) was somewhat limited, it is interesting to note that the output levels are quite similar to those depicted, even for 150-channel loading, as a result of the recent advancements in amplifier hybrid technology.

In recent years, as more dense areas of France were cabled, it was found that in many cases, the trunk output capability of the amplifier was not needed at every amplifier location. The architecture then evolved by disassociating the trunk amplification from that of the feeder, or bridger amplification. The resulting architecture is shown in Figure 10 (page 42).

The architecture for the Phase 1 area in the Queens upgrade draws from the strong points of each one of the two architectures to form a hybrid architecture as shown in Figure 11 (page 42). The resulting architecture can truly be considered a cable communications network (CCN) since the results create small pockets of customers, each served by a unique fiber-optic node. The expected reliability also qualifies the system to be considered as a CCN since amplifiers are limited to a total of three in cascade, little of the plant needs to pass 60 VAC powering and no more than four or five taps will be in cascade.

Summary

In conclusion, plant architectures exist that allow today's upgrade to provide an easy evolutionary path for a subsequent upgrade while remaining cost-effective. At the same time, these architectures create a true cable communications network that will support many future video, data and telecommunications services in an ideal manner. In addition, these approaches meet the objectives outlined earlier — that is, for a reliable, low maintenance system offering improved picture quality and expanded channel capacity. **CT**

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Reader Service Number 30

AM fiber supertrunks

(Continued from page 28)

ed within each group of channels. Furthermore, by "lightly loading" each laser, the index of modulation can be increased to maximize the link's carrier-to-noise ratio (C/N). At the same time composite triple beat (CTB) is restricted to extremely low levels.

The result is that one can achieve significant performance improvements in noise and intermodulation distortions over high channel loading on a single or dual laser for the same path loss. In fact, the performance levels compare quite favorably with FM fiber and digital fiber for short to medium distances (e.g., 5 to 15 dB of optical loss/8 to 25 miles). Refer to Table 2 (page 28) for typical AM supertrunk specifications.

In most cases AM supertrunks will be used where FM fiber, digital, microwave, long trunk amplifier cascades or some combination of these four were previously considered. In a large percentage of these applications, cable operators may have deployed or at least reviewed fiber as part of a rebuild or upgrade of the RF plant fed by one of the aforementioned technologies. Therefore, it is quite possible that we will see a proliferation of back-to-back AM fiber links. AM supertrunks can be used to feed single or dual fiber links or can even be completely repeated laser for laser. The required end-of-line performance will determine the technology required for service from the AM supertrunk hub site to the final service point. As an example, the AM supertrunk could travel 15 miles to a remote community (or hub site). At the receive site the output of the supertrunk might feed a dual 550 MHz transmitter in a 10 dB optical fiber-to-the-serving-area (FSA) style architecture. The minimum end-of-line performance to each subscriber in the service area after five high performance distribution amplifiers in cascade would be: C/N of -48.4 dB, CTB of -53.4 dB and CSO of -54.1 dB. Refer to Table 3 for system performance details.

Optical amplifiers

One question that must be answered is whether optical amplifiers or external modulation should be considered as serious alternatives for longer distance point-to-point type applications now that both of these technologies are approaching the reality stage. For systems considering back-to-back optical links such as the aforementioned FSA example, the answer is fairly simple. Neither technology has shown the capability of yielding both the noise and distortion values needed to meet the minimum end-of-line values required by most operators when combined with a single or dual fiber link and a cascade of high performance distribution amplifiers. (It is recognized that fiber-based technologies are evolving rapidly and this could change in the future.)

Although optical amplifiers can provide extremely high optical output levels or optical gain, depending on their position within a cable system, they suffer from being both C/N- and distortion-limited. Optical amplifiers typically have noise figures of at least 4 dB, which means that the maximum C/N for a typical fiber link, even with a high quality source laser, would be 52 dB. Furthermore, unless the channel loading is kept low, which increases the number of amplifiers (and the cost), an

Table 3: Typical AM supertrunk system performance

Performance parameter	15-mile AM supertrunk	10 dB 550 MHz dual fiber link	Combined fiber performance	5 high performance amplifiers	Final system performance
C/N	-56.8	-50	-49.2	-56.6	-48.4
CTB	-68	-65	-60.4	-58.5	-53.4
CSO	-70	-60	-59.6	-55.5	-54.1

Table 4: Technology performance comparison

Technology	15-mile (10 dB) fiber link performance[1*]			15-mile link + FSA link[2*]			15-mile link + 10 amps[3*]		
	C/N	CTB	CSO	C/N	CTB	CSO	C/N	CTB	CSO
AM supertrunk	56.8	70	68	48.4	53.4	54.1	47.2	52.5	54
FM fiber	62	80	80	48.9	54.7	54.2	47.6	53.7	54.5
Digital fiber	62	80	80	48.9	54.7	54.2	47.6	53.7	54.5

***Assumptions:** 1) FM fiber and digital distortions are essentially non-existent. 2) FSA link consists of a dual 550 MHz laser transmitter and five high performance distribution amplifiers. 3) FT 550 trunks, dual PHD bridgers, and PHD line extenders.

Table 5: Technology equipment cost and performance comparison

Technology	Approx. cost/ch.	Total cost 60 chs. (450 MHz)	Cost premium over AM supertrunk for 60 channels	Total cost 80 chs. (550 MHz)	Cost premium over AM supertrunk for 80 channels	C/N for 15-mi. fiber link + 10 dB dual fiber + 5 FF DAs (550 MHz)	C/N for 15-mile fiber link + 10 amps (550 MHz)
AM supertrunk	$2,000	$120,000	N/A	$160,000	N/A	48.4 dB	47 dB
FM fiber	$4,500	$270,000	$150,000	$360,000	$200,000	48.8 dB	47.4 dB
Digital fiber	$4,000	$240,000	$120,000	$320,000	$160,000	48.8 dB	47.4 dB

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Splitters are AC/DC passing on the low band side only. Passband loss is approximately 1 dB, except at band edges nearest the crossover frequency, where it is approximately 3 dB.

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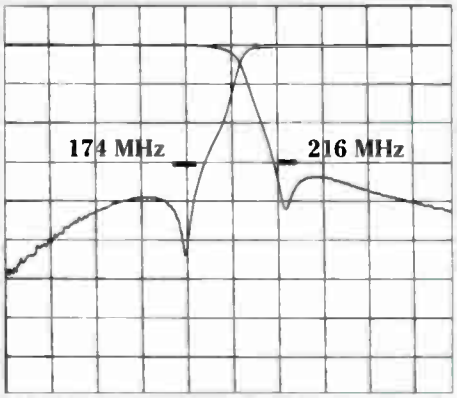
3329-57*	0 - 45.75	60 - 300	45 dB	Sub-band/VHF
3329-51.5(25)	0 - 48	54 - 450	25 dB	Sub-band/VHF
3329-51.5(40)*	0 - 48	54 - 450	40 dB	Sub-band/VHF
3329-38	5 - 33	54 - 500	25 dB	Sub/low VHF
3329-98	5 - 88	108 - 300	25 dB	Low VHF/Mid-band
3329-130	5 - 110	170 - 450	30 dB	Low/high VHF
3329-M/S	5 - 174	216 - 420	30 dB	Mid-band/Super-band
3329-375	54 - 300	470 - 890	25 dB	UHF/VHF

Baseplate dimensions: 2 1/4" x 6 1/8"

Series 3329 broadband cable bandsplitters includes a model for almost any normal CATV or LAN application and reflect a design capability spanning baseband (4.2 MHz) to UHF (890 MHz). We will quote promptly to your specifications for additional models for your special system or application.



3329-(M/S) Frequency Response

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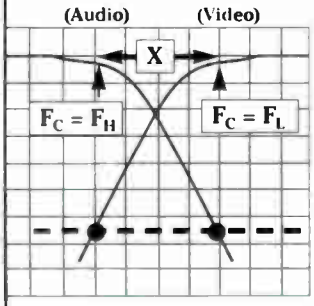

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9427H

19" x 5" Rack Panel

9428

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9429

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3329-(M/S)

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Low Pass	Adjacent	9426H-(F_H)	300 – 550	< 3	—	1.5	> 8	≈ 50ns
High Pass	Adjacent	9427L-(F_L)	54 – 300	—	< 3	1.5	> 8	≈ 50ns
High Pass	Adjacent	9427H-(F_L)	300 – 550	—	< 3	1.5	> 8	≈ 50ns
Splitter	Semi adjacent	9428-F_H/F_L	54 – 300	< 3	< 3	7.5	> 12	≈ 20ns
*Splitter	Adjacent	9429-F_H/F_L	54 – 300	< 5	< 5	1.5	> 12	≈ 50ns

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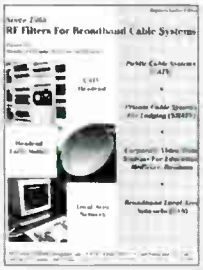

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optically amplified fiber link has difficulty consistently achieving the -68 to -70 dB distortion level required. For the near term, optical amplifiers will be limited to certain broadcast applications and a few long-haul "home run" applications where the optical amplifier is located in the headend and used to increase the distance of a fiber link.

External modulation

Various external modulation techniques are currently receiving a lot of attention. However, most of the discussion has been focused on their use in point-to-multipoint applications (i.e., broadcasting). That is not to say that the external modulation technology could not be used for certain point-to-point applications.

A couple of issues, however, will be difficult to overcome. First, AM supertrunks provide a distinct economic advantage. Since channels can be added in blocks of eight to 10 at a time, many operators will deploy only four or five laser/receiver pairs (e.g., in a 330 to 400 MHz system) and then add components as they expand the channel capacity of their system. This is an extremely cost-effective way to increase the capabilities of a cable system over time. In addition, external modulation, which is clearly a "broadcast" type technology, does not offer the flexibility that AM supertrunks do for discrete combining and distribution of ad insertion and specialized local programming. Finally, in spite of all of the performance hype, external modulation schemes have yet to prove their ability to consistently meet the -68 to -70 dB type of intermodulation distortion values required to meet most operator's end-of-line requirements for back-to-back FSA type fiber links. External modulation does, however, have its place in long point-to-point applications that do not contain a second fiber link, when narrowcasting of local programming and advertisements is not an issue, and when switched video is not under consideration.

We believe that AM supertrunks have the potential to be the most cost-effective, reliable method for most point-to-point applications for terrestrial communication of multichannel video. The big question each CATV engineer must answer is how much is a dB, or less, really worth?

A quick analysis of the end-of-line results for a series of amplifiers cascaded off of an AM supertrunk vs. some of the competing technologies reveals that the RF plant plays an enormous role in determining the noise and distortion levels of the cable system. Refer to Table 4 (page 46) for a comparison of the technologies that also meet the end-of-line performance specifications required by most cable operators.

In virtually all applications (e.g., FSA, headend-to-hub, fiber backbone) the difference in end-of-line performance levels between an AM supertrunk and any of the other technologies is a fraction of a dB. This means that for an insignificant performance penalty one can save up to $200,000 in equipment costs per link. (Refer to Table 5, page 46, for an approximation of equipment costs vs. performance.) Furthermore, this analysis excludes the additional costs associated with real estate, added equipment maintenance and additional power consumption.

Future applications

Does this mean that AM supertrunks will eliminate the need for the various technologies mentioned previously? Definitely not. There will be instances where the path distances are too great or the end-of-line requirements so high that current AM supertrunking technology will not meet the system's end-of-line requirements.

In the case of microwave transmission, there will always be instances where water has to be crossed or where the terrain is too rugged to place fiber-optic cable cost-effectively. It is clear, however, that AM fiber supertrunks will become another important tool in the cable engineer's ever-expanding "technology toolbox."

The degree to which AM supertrunks impinge on other technologies largely depends on how much further their performance can be improved. With the advanced technologies being discussed today (e.g., feedforward circuits, 1,550 nm lasers with compensation circuits), it is quite possible that the performance of the DFB type laser can be improved to a point where they will be able to cover significantly greater distances or handle a larger number of channels and achieve similar or better performance levels when compared with existing AM fiber supertrunks. This could, at least in theory, all but eliminate the need for FM fiber equipment and reduce digital applications to regional and long-haul interconnects or super headends. **CT**

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Industrial Technology

System requirements

(Continued from page 30)

• *Local detection.* The number of people needed to verify splice integrity can be reduced to two by using far-end transmission with local detection. With this method, light transmitted from Location A is detected immediately after the splice, rather than at Location B as shown in Figure 1 on page 30. The local detection might be accomplished by bending the fiber to cause some of its light to escape onto a photodiode.

Some fiber identifiers use this technique to verify a splice's continuity by alternately clipping the identifier onto the fiber before and after the splice (Figure 2, page 30). Likewise, some of the light lost at a splice can be gathered, guided to a photodiode and used to measure splice loss.

• *Local injection and detection.* Local injection and detection systems (LIDS) further simplify splice testing. They also reduce to one the number of people needed to perform the test. Light is injected into the fiber immediately before the splice and detected immediately after it. LIDS use the same detection principles as discussed earlier along with macro- or microbending methods for injecting light sideways into the fiber. LIDS that use macrobends serve as "optimizers" and give no indication of the splice's loss, while allowing the splice loss to be minimized.

"Local injection and detection systems (LIDS) further simplify splice testing. They also reduce to one the number of people needed to perform the test."

• *Optical time domain reflectometry.* An optical time domain reflectometer (OTDR) measures the light reflected from discontinuities and any continuous backscatter from the fiber itself. Changes in the backscattered signal between two points in a fiber show the loss between those points; this can be used to "estimate" the loss of the splice.

The measurement is only an estimate because OTDRs introduce an error that will depend on the similarity of the fibers on either side of the splice. Since the error may be either positive or negative, the measured splice loss may appear large when observed from one direction and low, or perhaps even a "gainer," when viewed from the opposite direction. The only way to overcome this OTDR limitation is to measure the splice from both directions and then average the two readings.

Although OTDRs have enough dynamic range to measure all splices from both directions in a loop distribution plant, bidirectional measurements are cumbersome to make. Consequently, splices are usually measured in only one direction and the measurement error taken into account when determining an acceptable OTDR splice loss reading. In addition to the inherent error depending on the fibers before and after a splice, an OTDR's receiver circuitry might introduce another error when used to measure the loss of a reflective joint.

Sudden changes in optical power (for example, going from a small backscattered signal to an intense reflected power) will temporarily satu-

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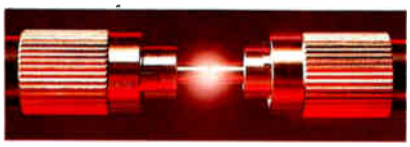

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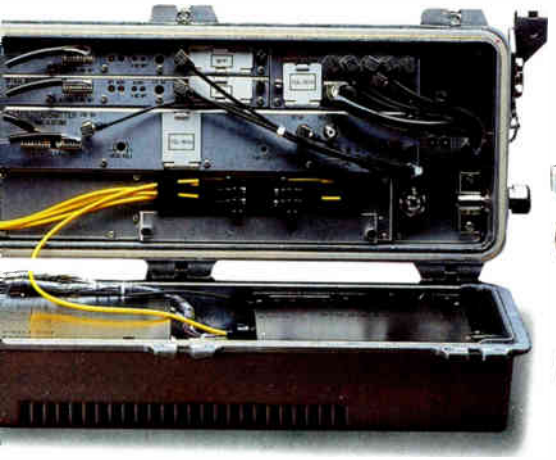

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rate the receiver. Time is required for the receiver to recover during which the true signal backscattered from the second fiber is distorted. Unless the OTDR has a masking feature, this sudden change in signal power impairs its ability to measure the loss of reflective joints.

Another limitation, imposed by the pulse width of the OTDR, is its ability to resolve closely spaced events. High resolution requires narrow pulses, but this leads to reduced pulse power and therefore, a decrease in measurement range. The resolution of most OTDRs designed for the local loop requires events to be at least 15 meters apart.

End-to-end loss testing

After installation of the fiber, splices and connectors, end-to-end loss tests are made on each fiber path. The fiber is accessed through optical connectors at the DT and the interconnect cabinet in the RT (Figure 3, page 30). The measured loss must be smaller than the maximum loss permitted by the operating system.

For AT&T's current loop distribution system, the measured loss between the connectors at the RT and DT must be less than 6.6 dB at 1,310 nm in any environment, whether it's buried or underground (15 to 170°F), or normal aerial (-10 to 170°F). This 6.6 dB value should be further reduced at the time of installation to include a margin for future repair splices. This will ensure an allowance to conform to the 6.6 dB path loss requirement even after making additional repair splices. Two repair splices should be budgeted for each type of splice used to build the plant.

When a system is constructed with high-quality components, there is a low probability that reflectances will cause system failure, so routine reflectance tests are not justified. However, for those wanting to make tests, there are two predominant methods. The "coupler method," sometimes called optical continuous wave reflectometry, measures the total reflectance from the fiber and all components. The second method is to use an OTDR to measure the reflectance from the fiber and all components. AT&T's system does not require maximum individual component reflectance from all the components including the fiber.

Short wavelength operation

When operated below its cutoff wavelength, a single-mode fiber behaves like a step-index multimode fiber carrying two or three modes. Recently, interest has increased in operating single-mode fibers at short wavelengths (780-850 nm) because of the widespread availability of inexpensive audio compact disc (CD) lasers. CD lasers offer the prospect for economy and volume production that may never be attained with long wavelength sources.

The next generation SLC Series 5 system offering will likewise use short wavelengths for POTS and 1,310 nm for video. If there are no extensive testing burdens on fiber manufacturers and installation technicians, the potential economies of short wavelength transmission can be fully exploited. This can be done by characterizing fiber, splices and connectors at short wavelengths and then using this information to establish a 780 nm loss budget so the 1,310 nm budget will be more restrictive. In this way, installations that meet the 1,310 nm loss budget will, with high assurance, meet the 780 nm loss budget and thereby preclude the need for short wavelength field measurements. **CT**

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Fiber improves image

(Continued from page 32)

nology. Those sections include:

- Promotional materials
- Operations
- Public relations
- Involvement of community leaders and legislative officials

Promotional materials

To help communicate a system's technology investment directly to the subscriber, bill stuffers, print advertisements and lobby posters have been created, along with on-hold message scripting and recommendations for commercial spots and "infomercials." The print materials can be customized with an operator's logo and sent directly to the billing company at a nominal cost.

Local origination facilities should be put to use promoting optical technology. Projects to consider might include infomercials for local origination programming or 30- to 60-second spots promoting the system's use of optical technology. The handbook offers guidelines and suggestions as to the content and types of promotions to consider. As well, clips of high tech images are available from ONI.

Operations

A well-executed community awareness campaign involves coordination among several departments. Engineering and construction, sales and marketing, community relations, customer service and general management should all be informed of (and be involved in) the system's fiber project to ensure its success. It is recommended that the engineering department conduct a basic training session for all non-technical personnel to familiarize everyone with the fiber project. The aforementioned handbook provides question and answer sheets for customer service representatives that enable them to handle calls from subscribers asking questions about the fiber project.

The handbook also contains detailed "how-to" information on press conferences, activation ceremonies and CSR training. Taking the proper steps in preparing for such promotional activities will ensure that the community understands the benefits of fiber technology.

Public relations

The PR section of the handbook offers sample press releases, press event checklists and suggestions for keeping the fiber project featured in the local media. Press releases are important tools for disseminating information about an event. You should work with marketing personnel to make sure a general description of optical benefits is included in a press release, as well as information pertinent to the specific system.

As with the entire campaign effort, press releases should not be sent out solely for the activation event itself. Marketing and public relations personnel should be kept updated by the engineering staff as to the project status. This information should, in turn, be included in regular press releases to keep the community informed and up-to-date about the project. This is especially important if an outage is anticipated at any time for specific reasons — construction, splicing, etc.

Involvement of leaders

One of the best ways to gain the support of community and legislative leaders is to involve them in the process of bringing the new technology to their communities. This also is the perfect opportunity for technical personnel to show off the new system. Whenever possible, make sure local community leaders are invited to take an active role in system events. Media exposure is often a strong motivator for leaders, as well as an opportunity to be associated with high technology in the community. The higher the level of the presiding official, the more extensive the coverage will be by local news reporters.

System campaigns

Tele-Communications Inc. is one MSO that actively implements such an awareness program. Beginning with the first quarter of 1991, TCI East began conducting campaigns to promote the initial activation of fiber in its eastern systems. The primary motivation for such a campaign, according to Bill Tierney (director of government affairs for TCI East) was to improve the image of its cable systems.

Because of the investment made in deploying fiber optics, TCI saw a need to call attention to the technology and its benefit to the subscriber. This enabled the MSO to position itself as a provider of "cutting edge" technology. It also promotes a sense of pride in smaller communities that see themselves as leaders in fiber-optic usage.

For TCI, the focal point of such an awareness campaign is a local reception. Speakers from the local TCI management, corporate members of TCI and representatives from ONI are on hand to demonstrate the "how, what and why" of fiber-optic technology. The guest list includes as many community leaders, cable committee members and press members as possible. At the reception, brochures also are handed out that explore the optical technology in depth.

Although Tierney says most people understand the concept of fiber and what it is, they don't know how it works and what it can do. These receptions, as well as a 30-second commercial produced by TCI and targeted to the customer are designed to better equip the consumer with fiber knowledge.

One system, Cox Cable in Gainesville, Fla., won kudos for keeping the local cable advisory committee informed of what was happening in the system. According to Ken Williams, plant manager for the system, the committee was impressed with the awareness campaign Cox implemented and many of the committee members stated they could see an improvement in picture quality once the fiber was installed.

These efforts are representative of a much larger universe of systems seeking to promote a better image in the community. With fiber-optic technology, managers are finding that keeping the community well advised actually reinforces a good image of the cable industry and the product it delivers.

Throughout any promotional campaign, it is essential to convey to consumers and community leaders that optical deployment is not a minor advancement. It is a tool that offers the consumer more than an enhanced and reliable viewing experience. The deployment of fiber is a lead-in to the type of system consumers often hear referred to as the communications infrastructure of the future.

It is important that operators not only make consumers aware of the capabilities and future potential of fiber, but that operators take advantage of the marketing value of this tremendous technology. For the technical community, this means a firm commitment to work with marketing and public relations personnel in an effort to better understand and better promote the benefits of optical technology. **CT**

Bottom line training

(Continued from page 36)

employees have the knowledge and experience to do their job in an efficient, cost-effective manner? After all, they are correcting problems and providing service to the customers, and have been doing so for years.

There are several tools available to help you make these determinations. Have some of your best installers and service techs enroll in the SCTE's Installer Certification Program and see how well they do. Check the number of installations that have required a service call within six months of the installation date and note the cause of the problem. Review the trouble calls for the next six months and see how many drop fittings were replaced, how many converters were replaced at the same location, and how many times a technician had to return to the same location.

Talk to your technicians and ask them what kind of training they feel that they need. For your senior techs, look into the SCTE's Broadband Communications Technician/Engineer Certification Program that certifies members of your technical staff at the technician or engineering levels in their areas of work.

There are many sources of good training for your technical staff. First and foremost you must have a good in-house training program consisting of classroom and field training. This training needs to be supplemented by the programs that are conducted by manufacturers, technical training courses such as those offered by the National Cable Television Institute, and professional organizations such as the SCTE.

While we are looking at training, let's not forget the safety training requirements. Huge dollar savings can be realized through safety programs that reduce costly time loss and property damage accidents, as well as ensuring that your system meets all of the Occupational Safety and Health Administration standards to avoid having to pay those nasty fines.

Looking at the bottom line, training is probably the best investment in a cable system that can be made. It needs to be a matter of primary interest to every manager, from the newest employee to the most experienced individual on your staff. The dollar amounts that can be realized depend upon the size of your system or company, but the percentage of savings is about the same regardless of the system size. **CT**

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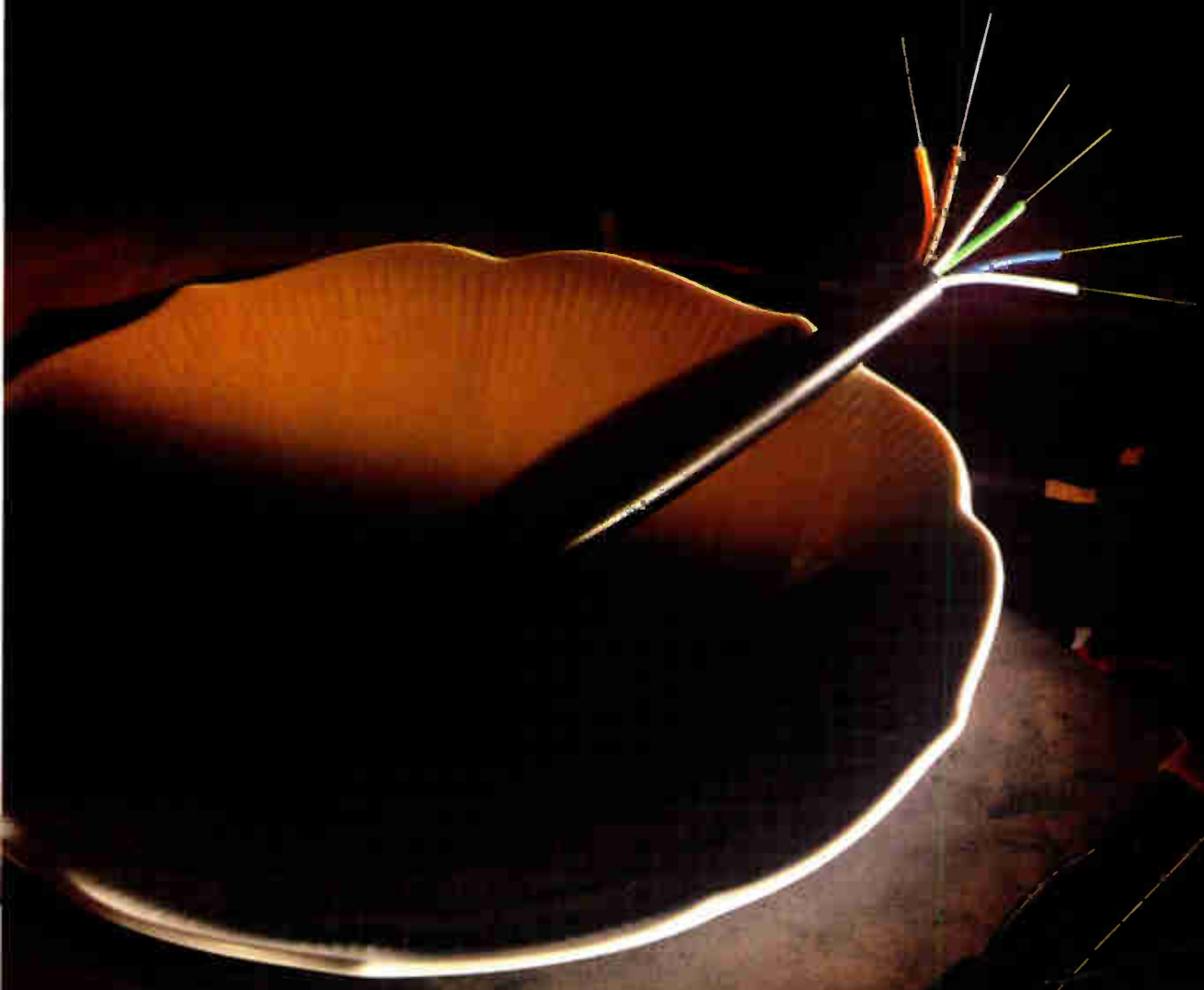

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Skill-based pay

(Continued from page 38)

may include job redesign. Some United Artists systems (Editor's note: UA recently was acquired by TCI) have changed from the traditional technical reporting structure to one that has customer contact personnel — including installers and technicians — reporting to a customer service manager (see *Cable World*, May 20, 1991). The New England Region of Continental Cablevision has recently completed a second round of its skill-based pay program and has instituted "field service technicians" in lieu of the traditional installer and tech positions. These types of structures are well suited to fit a skill-based pay program. Jones Intercable has just begun to explore this area. Continental Cablevision's plan, as described to me by Lee Kavanaugh (director of training) and Gerard Reese (human resource manager) will be used to illustrate concepts throughout the rest of this article.

Armed with your company vision and an outline of associate positions included in the program, it's time to get down to the mechanics of the actual skill blocks. A skill block is a grouping of skills that define a position or level. For example, Continental's plan for installers and service technicians encompasses the positions of field service technician 1 through 4. The activities necessary to complete each level are highlighted. This step should be done by someone who knows the positions very well.

The key in developing the skill sets is "multiskills." The service technician position typically has been seen as a promotion. Another part of the new culture that technicians may need to get used to is "installs are part of my job." The responsibilities of each new position include all those of previous positions. In other words, at Continental, the field service technician 3 may perform installations as well as service calls (as is needed).

The certification plan encompasses the methods for ensuring the skills are learned in a reasonable time frame. Continental has set minimums of a six-month period for each of the four positions (mentioned previously) before moving to the next position. Ideally, minimum time frames should be avoided so associates can move through the program as quickly as possible. But administrative and financial constraints may prevent this. To ensure skills are learned, it's best to test by way of observance and review the actual results. The frequency, criteria and fairness of testing procedures must be determined for certification. Recertification should be planned to prevent skill loss.

Part of the design includes setting up structures that support processes and encourage the involvement of the associates. The training plan must be in place before implementing the program. Otherwise, rapid-moving associates may be ready to move onto the next step with no place to go. If the next training and/or evaluation step is not ready, bottlenecks may result, causing administrative problems and low morale among the high achievers.

Also consider a plan that offers smooth transition from the old to the new. Decide how the information will be delivered to your associates. There may be interim training necessary. Marc Wallace suggests creating a model with assumptions showing where associates will be in their career path in five years. Set up a comparison of what their pay will look like under the

"Under a skill-based pay program, specific skills are evaluated and pay is based primarily or entirely on skills, not seniority or other factors such as with a job-based pay plan."

old and new systems so they can actually see the benefits. There may be exceptions, so plan to deal with the dilemma of highly paid/low-skill associates. Continental's plan allows their systems one year to make the transition.

Implementation

Earlier in this article it was pointed out that skill-based pay is 10 percent pay and 90 percent organization. I believe you'll find out in the implementation how good your organization is! As with any new program, clear communications and a "one-on-one" style is most effective. The associates involved with the development can help with the communications. Also keep in mind that since skill-based pay creates a different culture than people are used to, you need to be sensitive to their feelings.

When Continental launched the first iteration of its career path four years ago, positions were created to accommodate associates who were performing well in their area but did not have all the required training. Also, under the old plan, position openings had to be available before the associate could advance. Under Continental's recently completed plan, advancement can be done as soon as the associate completes the criteria (including being in the position for the minimum of six months). Thus, the responsibility for the associate's career is put in the hands of the associate, where it should be! This also makes the development of goals and accountability to these goals easier.

Possible problems

Implementing a program like this is not without problems. By far the largest failure has been for companies to underestimate the amount of resources necessary, including time and cost to do the training and testing of skills. Initially, the overall costs in the areas of

labor, training and administration will be 5 to 10 percent higher. The break-even point is about five years out. As mentioned earlier, bottlenecks may result that prevent people from moving through the system within the designated time.

Some associates just won't like the new system. It is estimated that an organization may lose 20 percent of the work force if they don't fit into the structure. "Topping out" in a position needs to be considered. As technology changes, the associate at the top is responsible for staying current without expecting additional pay. However, pay should stay current with the market. Continental continues to pay their employees a merit increase based on performance in addition to the skill-based pay increase. Many companies also use gain-sharing as part of the total compensation package. Part of this culture change is a shift from viewing associates as factor of production to collaborators in a work team. Group incentives also are used in addition to individual rewards.

According to Reese at Continental, the first reaction from some associates was fear — they would have to go to school! Many were afraid that since they had been out of school for so long, they would not do well. The students discovered, however, that it was not as bad as they imagined. Plus, it was easier if they took the prerequisites. Maintenance technicians, who had been around the longest and felt comfortable with doing their job, were not forced into the program. But, they also did not receive any of the monetary rewards for taking the classes.

Building blocks

Within Jones Intercable — specifically, the Mind Extension Institute — a new interactive video program, The Qualified Technician Program, will be designed in modular form. This will simplify the development of skill blocks and testing procedures.

Also, the Society of Cable Television Engineers has started a new subcommittee: the Broadband Communications Technician/Engineer Career Path Subcommittee. This group has been formed to create a BCT/E certification process that more closely resembles a typical career path progression. The subcommittee is chaired by Ron Wolfe of ATC, and consists of other training authorities in the industry: Alan Babcock (Warner Cable), Tom Brooksher (National Cable Television Institute), Bill Williams (Continental Cablevision) and myself. The final product should lend itself well to a skill-based pay program.

Achieving the final product is not an overnight process. Continental Cablevision's plan took 18 months to design. Jones Intercable has estimated a similar time frame to complete this step. This article just scratches the surface of what is necessary to move toward improved quality, productivity and customer service — just one more step toward meeting the needs of our associates and our customers. **CT**

References

1) Strickland, Donald E. and Tucker, Sharon A., "Role of Compensation in High-Commitment Organizations", *Perspectives in Total Compensation*, June 1991.

2) "Skill-Based Pay Programs," American Compensation Association, taught by Marc Wallace, professor of business at the University of Kentucky.

The author would like to thank Lee Kavanaugh and Gerard Reese of Continental Cablevision's New England Region for their assistance.

Hazardous chemicals

(Continued from page 40)

ees in the use of, or exposure to, hazardous chemicals in the workplace. It should include "initial" or new-hire training methods as well as those for employees who have been transferred. The training statement should briefly detail the key elements of the training program.

7) Contract employers: A statement detailing your requirements for a contract employer who may bring hazardous chemicals onto your site. It also should detail your responsibilities (e.g., training and providing personal protective equipment) if you provide the contractor with hazardous chemicals or substances.

8) Additional information: A statement that informs employees where they can get additional information or who to contact in case of emergency.

The written hazard communication program is one of OSHA's focus areas for the 1990s. If an OSHA compliance officer should visit your facility, he will ask to review your written program. If you don't have one or it is inadequate, you can expect to be cited and fined.

Hazardous chemical search areas

Office area
Warehouse
Vehicles
Janitorial closet
Bathrooms
Basement storage areas
Storage shed/outbuildings
Attic storage areas
Break room
Outside storage areas

The chemical list

Every system must have a list of all hazardous chemicals or toxic substances present in the system. This list also must be a part of the written program and must be made available for employees to review.

Even though we don't generally think of our industry as one that uses a lot of hazardous chemicals, you might be surprised at the number and diversity of chemicals on your list.

It is important that the individual making the list *not* limit the inspection to field-related activities. A thorough inspection will include the warehouse, break room, kitchen, bathroom, janitorial closet, repair bench, warehouse, basement and other storage areas.

An average cable system will have 50 to 75 hazardous chemicals on its list!

Material safety data sheets

For every chemical on your system's list, there must be a corresponding MSDS. These sheets are informative in nature and are provided by the manufacturer or distributor. If an MSDS was not provided when the chemical was purchased, it is the employer's responsibility to procure it.

Each MSDS must be correct, up-to-date and available for employee review. The information on the MSDS provides such information as: chemical identity, hazardous ingredients, physical and chemical characteristics, fire and explosion data, reactivity data, health hazards, precautions for safe handling and use and control measures. These sheets are an important part of any system's hazard communication program. Each employee should be trained to read and understand the MSDS for the chemicals to which they are exposed.

Labeling

If your system uses or stores chemi-

cals in the workplace or field, the containers in which they are transported or stored must be labeled.

In reality, it is the chemical manufacturer's responsibility to label the chemicals they ship to you. If they fail to do so, it becomes your responsibility to ensure that those hazardous chemicals are labeled.

Many of the products used in the typical cable system also are consumer-type products such as glue, solvents, inks, cleansers, etc. Many of these products are already labeled as a requirement of the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substance Act (15 U.S.C. 1261 et seq.). This labeling often begins with such key words as "caution" or "warning." Although it's not necessary to relabel these chemicals, they must be listed on the system hazardous chemical list and an MSDS must be on file.

Training

Under the Hazard Communication Standard, each employer is required to inform and train employees at the time of their initial assignment to a work area where hazardous chemicals are present and whenever a new hazard is introduced into the work area. Following are the topics that should be covered in the training program:

"In actuality, the office has as many, or more, hazardous chemicals as the field."

1) The provisions of the Hazard Communication Standard.

2) Any operations in employees' work areas where hazardous chemicals are present.

3) The location and availability of the company's written hazard communication program, including the required list(s) of hazardous chemicals and MSDSs required by the Hazard Communication Standard.

4) Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area.

5) The physical and health hazards of the chemicals in the work area.

6) The measures employees can take to protect themselves from these hazards, including information on work practices, emergency procedures and personal protective equipment required by the employer.

7) The details of the employer's written hazard communication program, including an explanation of the labeling system used by the employer, MSDSs, and how employees can obtain and use the appropriate hazard information on the labels and in the MSDSs.

Unfortunately, there are many cable systems nationwide that don't presently have a hazard communication program in place. This is partly due to the fact that this law is relatively new and partly due to the fact that many systems still don't have a formal safety program in place.

Keep in mind that any cable system can have the type of accident that will bring to that system an OSHA compliance officer. During that compliance visit, regardless of the nature of that visit, he will ask to review the system's written Hazard Communication Standard compliance program. Those systems that have put a program in place should do well. Those systems with no program will not do so well. Good intentions alone will not help. **CT**

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BACK TO BASICS

The training and educational supplement to Communications Technology magazine.

Gen Saye

Table of Contents

System balancing and thermal compensation

By Brian Wilson
Engineering Consultant
National Communications Services

The effects of supplying heat to a material can involve changes in dimensions, as well as in color, state and electrical resistance. Most substances expand when heated and contract when cooled. These effects are known as thermal movement.

When heat is applied to coaxial cable, expansion occurs in all directions. When heat energy is removed from coaxial cable, contraction occurs in all directions. Cable attenuation also increases with higher temperatures and decreases at lower temperatures.

Real-world considerations

Manufacturers specify cable loss at 68°F, however, we must consider that loss variances due to temperature changes are 1 percent of change for every 10°F change in temperature per 100 feet of cable. Therefore, the greater the length of cable, the greater the change in cable loss per variation in temperature.

In the real-world environment, not only would the ambient temperature be a factor of loss variances, but solar heating and radiative cooling should be considered. Direct sunlight can elevate bare aluminum cable temperature as much as 24°F over ambient and 45°F for jacketed cable. On clear nights bare aluminum cable can drop 4°F below ambient and 8°F for jacketed cable.

Sweep technicians should closely observe ambient temperatures during routine balancing procedures. When an amplifier station is set up in the manual mode, cable loss variations due to change in temperature should be counterbalanced during the selection of input attenuation, equalization and amplifier operating levels.

Temperature compensation may be defined as adjusting the input and output of an amplifier station to a decreased or increased level, conditional on temperature variances and cable length in order to maintain optimum amplifier noise and distortion characteristics. When the temperature is restored to 68°F, the input and output of the amplifier station will be operating at the designed 68°F input and output operating levels.

Changes in cable loss can be calculated using the following formula:

Change in dB = C x (68°F - T) x .001

Where:
C = cable loss
T = ambient temperature (°F)

Based on the changes in the example that immediately follows, a pad should be selected to attenuate the amplifier input 1.25 dB below its designed input. An equalizer should be selected to compensate 1 dB of reverse tilt:

Change in dB = 24 x (68 - 120) x .001

Where:
24 = cable loss in dB at 450 MHz
120 = ambient temperature (°F)

Therefore, change in dB = 1.25 at 450 MHz

Change in dB = 8 x (68 - 120) x .001

Where:
24 = cable loss in dB at 55 MHz
120 = ambient temperature (°F)

Therefore, change in dB = .4 at 55 MHz

Here is another example:
- Amplifier input at 68°F = 10 dBmV flat
- Amplifier input at 120°F = 9.6 dBmV at 55 MHz, 8.8 dBmV at 450 MHz
- Amplifier output at 68°F = 30 dBmV at 55 MHz, 34 dBmV at 450 MHz
- Amplifier output at 120°F = 29.6 dBmV at 55 MHz, 32.8 dBmV at 450 MHz

After the amplifier station input and output levels have been adjusted in the manual mode to compensate for cable loss variations, the station will be set to operate in the automatic mode for the designed 68°F output operating levels. Figure 1 is another example and signifies inputs and outputs at 450 MHz.

Referring to the temperature compensation chart on the facing page, note the various amplifier inputs, outputs, pad and equalizer selection, cable footage and reserve gains. On Line 12 note the input and output variations selected at 68°F, 120°F and -20°F. Also note that the pad, equalizer and cable footages are calculated at 68°F.

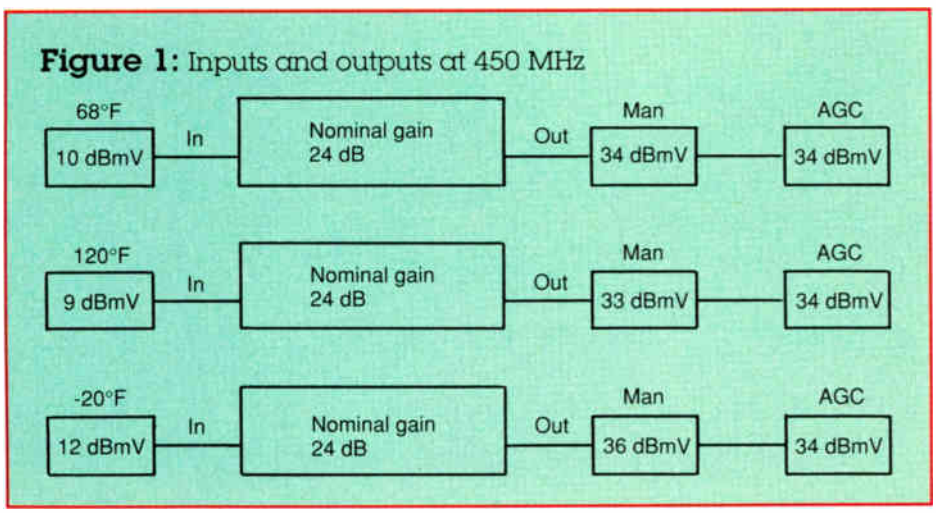
When correct temperature compensation methods are employed, no more than 2 dB of change will be observed in a temperature swing of -20°F to 120°F per amp spacing (see Figure 2 on page 72). However, if an amplifier is adjusted at an ambient temperature of 120°F to the designed operating levels of 68°F, you could expect a 3.2 dB change per amp spacing at 450 MHz with a 14 percent change in cable attenuation.

Pad and equalizer selection

An incorrect pad and equalizer selected for ambient conditions at temperature extremes will intensify distortion and noise characteristics significantly. The automatic control module compensation specifications could be functioning marginally.

The next example signifies two equalizer selections calculated with 2,000 feet of cable preceding the station at 68°F and -20°F. If the ambient

Figure 1: Inputs and outputs at 450 MHz



Temperature compensations

SYTEM))))))	CUMMING, IA.	TEMPERATURE IN 'F))))))	68
MANUFACTURER))))))	BRAND A	CHANNELS/PILOTS))))))	2 LP MP HC 62
MODEL #))))))	1152	FREQUENCY IN MHz))))))	55 67 295 397 450
STATION INPUT))))))	10	DESIGNED OUTPUTS))))))	30.0 30.1 32.4 33.5 34.0
OPERATING GAIN))))	24	CABLE LOSS AT 100FT))))))	0.33 0.35 0.74 0.91 1.00
CABLE TYPE)))))))	BRAND X	RESERVES AT 68'F)))))	3.5 3.6 5.6 4.5 4.0

TABLE 1. PAD AND EQUALIZER SELECTION. COMPENSATED MANUAL OPERATING LEVELS.

	68 INPUT 450	68 INPUT 397	68 INPUT 295	68 INPUT 67	68 'F INPUT 55	68'F EQ	68'F CABLE IN PAD FEET		68 'F MANUAL AMP SETTINGS 55	67	295	397	450	68 'F SLOPE AND GAIN RESERVES 55	67	295	397	450	
LINE																			LINE
1	22.0	22.5	23.6	25.9	26.0	8	11	1200	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	1
2	21.0	21.6	22.8	25.6	25.7	9	10	1300	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	2
3	20.0	20.7	22.1	25.2	25.4	10	9	1400	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	3
4	19.0	19.8	21.4	24.9	25.1	11	8	1500	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	4
5	18.0	18.9	20.6	24.5	24.7	12	7	1600	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	5
6	17.0	18.0	19.9	24.2	24.4	13	6	1700	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	6
7	16.0	17.1	19.2	23.8	24.1	14	5	1800	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	7
8	15.0	16.2	18.4	23.5	23.7	15	4	1900	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	8
9	14.0	15.3	17.7	23.1	23.4	16	3	2000	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	9
10	13.0	14.4	17.0	22.8	23.1	17	2	2100	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	10
11	12.0	13.4	16.2	22.4	22.7	18	1	2200	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	11
12	11.0	12.5	15.5	22.1	22.4	19	0	2300	30.0	30.1	32.4	33.5	34.0	3.5	3.6	5.6	4.5	4.0	12

TABLE 2. PAD AND EQUALIZER SELECTION. COMPENSATED MANUAL OPERATING LEVELS.

	120 INPUT 450	120 INPUT 397	120 INPUT 295	120 INPUT 67	120 'F INPUT 55	68'F EQ	68'F CABLE IN PAD FEET		120 'F MANUAL AMP SETTINGS 55	67	295	397	450	120 'F SLOPE AND GAIN RESERVES 55	67	295	397	450	
LINE																			LINE
1	21.4	22.0	23.1	25.7	25.8	8	11	1200	29.8	29.9	31.8	32.8	33.4	3.3	3.4	6.2	5.2	4.6	1
2	20.3	21.0	22.3	25.3	25.5	9	10	1300	29.8	29.9	31.8	32.8	33.3	3.3	3.4	6.2	5.2	4.7	2
3	19.3	20.1	21.6	25.0	25.1	10	9	1400	29.8	29.9	31.7	32.7	33.3	3.3	3.4	6.3	5.3	4.7	3
4	18.2	19.1	20.8	24.6	24.8	11	8	1500	29.7	29.9	31.7	32.7	33.2	3.2	3.4	6.3	5.3	4.8	4
5	17.2	18.1	20.0	24.2	24.4	12	7	1600	29.7	29.8	31.6	32.6	33.2	3.2	3.3	6.4	5.4	4.8	5
6	16.1	17.2	19.2	23.9	24.1	13	6	1700	29.7	29.8	31.5	32.6	33.1	3.2	3.3	6.5	5.4	4.9	6
7	15.1	16.2	18.5	23.5	23.8	14	5	1800	29.7	29.8	31.5	32.5	33.1	3.2	3.3	6.5	5.5	4.9	7
8	14.0	15.3	17.7	23.1	23.4	15	4	1900	29.7	29.8	31.4	32.5	33.0	3.2	3.3	6.6	5.5	5.0	8
9	13.0	14.3	16.9	22.8	23.1	16	3	2000	29.7	29.8	31.4	32.4	33.0	3.2	3.3	6.6	5.6	5.0	9
10	11.9	13.4	16.1	22.4	22.7	17	2	2100	29.6	29.8	31.3	32.4	32.9	3.1	3.3	6.7	5.6	5.1	10
11	10.9	12.4	15.4	22.0	22.4	18	1	2200	29.6	29.7	31.3	32.3	32.9	3.1	3.2	6.7	5.7	5.1	11
12	9.8	11.4	14.6	21.6	22.0	19	0	2300	29.6	29.7	31.2	32.3	32.8	3.1	3.2	6.8	5.7	5.2	12

TABLE 3. PAD AND EQUALIZER SELECTION. COMPENSATED MANUAL OPERATING LEVELS.

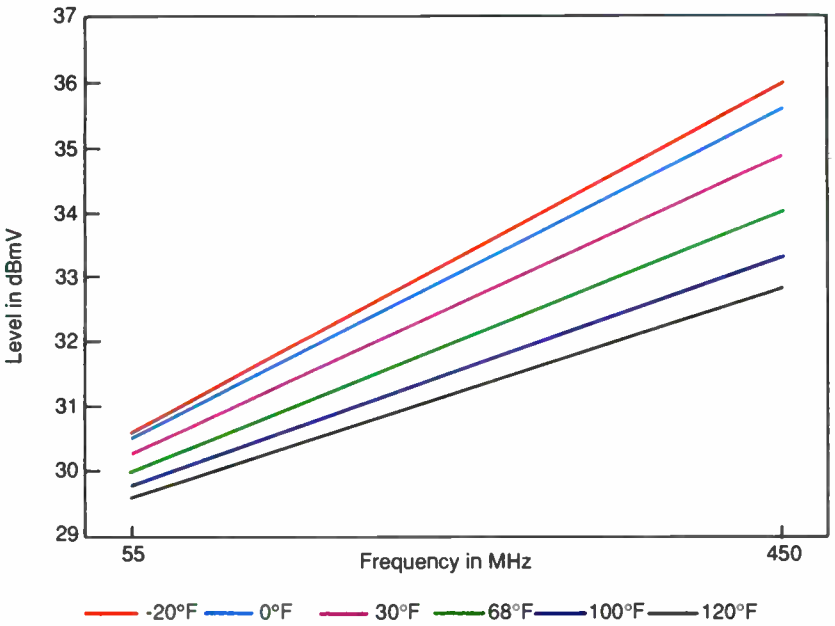
	-20 INPUT 450	-20 INPUT 397	-20 INPUT 295	-20 INPUT 67	-20 'F INPUT 55	68'F EQ	68'F CABLE IN PAD FEET		-20 'F MANUAL AMP SETTINGS 55	67	295	397	450	-20 'F SLOPE AND GAIN RESERVES 55	67	295	397	450	
LINE																			LINE
1	23.1	23.5	24.4	26.3	26.4	8	11	1200	30.3	30.5	33.5	34.5	35.1	3.8	4.0	4.5	3.5	2.9	1
2	22.1	22.7	23.7	26.0	26.1	9	10	1300	30.4	30.5	33.6	34.6	35.1	3.9	4.0	4.4	3.4	2.9	2
3	21.2	21.8	23.0	25.6	25.8	10	9	1400	30.4	30.5	33.7	34.7	35.2	3.9	4.0	4.3	3.3	2.8	3
4	20.3	21.0	22.3	25.3	25.5	11	8	1500	30.4	30.6	33.8	34.8	35.3	3.9	4.1	4.2	3.2	2.7	4
5	19.4	20.2	21.7	25.0	25.2	12	7	1600	30.5	30.6	33.8	34.9	35.4	4.0	4.1	4.2	3.1	2.6	5
6	18.5	19.4	21.0	24.7	24.9	13	6	1700	30.5	30.6	33.9	35.0	35.5	4.0	4.1	4.1	3.0	2.5	6
7	17.6	18.5	20.3	24.4	24.6	14	5	1800	30.5	30.6	34.0	35.0	35.6	4.0	4.1	4.0	3.0	2.4	7
8	16.7	17.7	19.7	24.1	24.3	15	4	1900	30.6	30.7	34.1	35.1	35.7	4.1	4.2	3.9	2.9	2.3	8
9	15.8	16.9	19.0	23.7	24.0	16	3	2000	30.6	30.7	34.2	35.2	35.8	4.1	4.2	3.8	2.8	2.2	9
10	14.8	16.0	18.3	23.4	23.7	17	2	2100	30.6	30.7	34.3	35.3	35.8	4.1	4.2	3.7	2.7	2.2	10
11	13.9	15.2	17.6	23.1	23.4	18	1	2200	30.6	30.8	34.4	35.4	35.9	4.1	4.3	3.6	2.6	2.1	11
12	13.0	14.4	17.0	22.8	23.1	19	0	2300	30.7	30.8	34.5	35.5	36.0	4.2	4.3	3.5	2.5	2.0	12

DIRECTIONS:

1. PER THE AMBIENT TEMPERATURE SELECT THE APROPRIATE TEMPERATURE CHART.
2. CONNECT A SIGNAL LEVEL METER TO INPUT TEST POINT.
3. MEASURE SIGNAL LEVEL AT HIGHEST FREQUENCY))) 450 MHz.
4. PER THE AMBIENT TEMPERATURE, SELECT THE INPUT AT) 450 MHz THAT CORRELATES TO THE READING AND SELECT THE PAD AND INSERT INTO TRUNK STATION.
5. ADD PASSIVE LOSS TO INPUT READING, SELECT EQUALIZER AND INSERT INTO TRUNK STATION.
6. SET LEVELS IN THE MANUAL MODE TO THE OUTPUT LEVELS PROVIDED.
7. ASSURE PROPER GAIN AND SOPE RESERVES ARE SET IN THE STATIONS MANUAL MODE.
8. SET LEVELS IN THE STATIONS AUTOMATIC MODE TO THE DESIGNED OUTPUT LEVELS.

NOTE: MANUAL TRUNK STATIONS AND BRIDGERS SHOULD BE SET TO OPERATE AT TEMPERATURE COMPENSATED OPERATING LEVELS.

Figure 2: Temperature variations



temperature is -20°F and the cable loss is 20 dB, which pad and equalizer should be selected? A 1 pad and 19 equalizer at 68°F would be the correct choice:

To calculate the equalizer value:
Cable loss at 450 MHz - 4 - passives = EQ value.
Cable loss is determined at 450 MHz
Cable length = 2,000 feet
Station output = 34 dBmV
Input @ 68°F = 12 dBmV; cable loss = 22 - 4 = 18 or a 19 EQ.
Input @ -20°F = 14 dBmV; cable loss = 20 - 4 = 16 or a 16 EQ.

To calculate the pad value:
Input @ 450 MHz - EQ loss at 450 MHz - desired input of 10dBmV = pad value.
Cable length = 2,000 feet
Station output = 34 dBmV
Input @ 68°F = 12 dBmV - EQ loss of 1 = 11 - 10 or a 1 pad.
Input @ -20°F = 14 dBmV - EQ loss of 1 = 13 - 10 or a 3 pad.

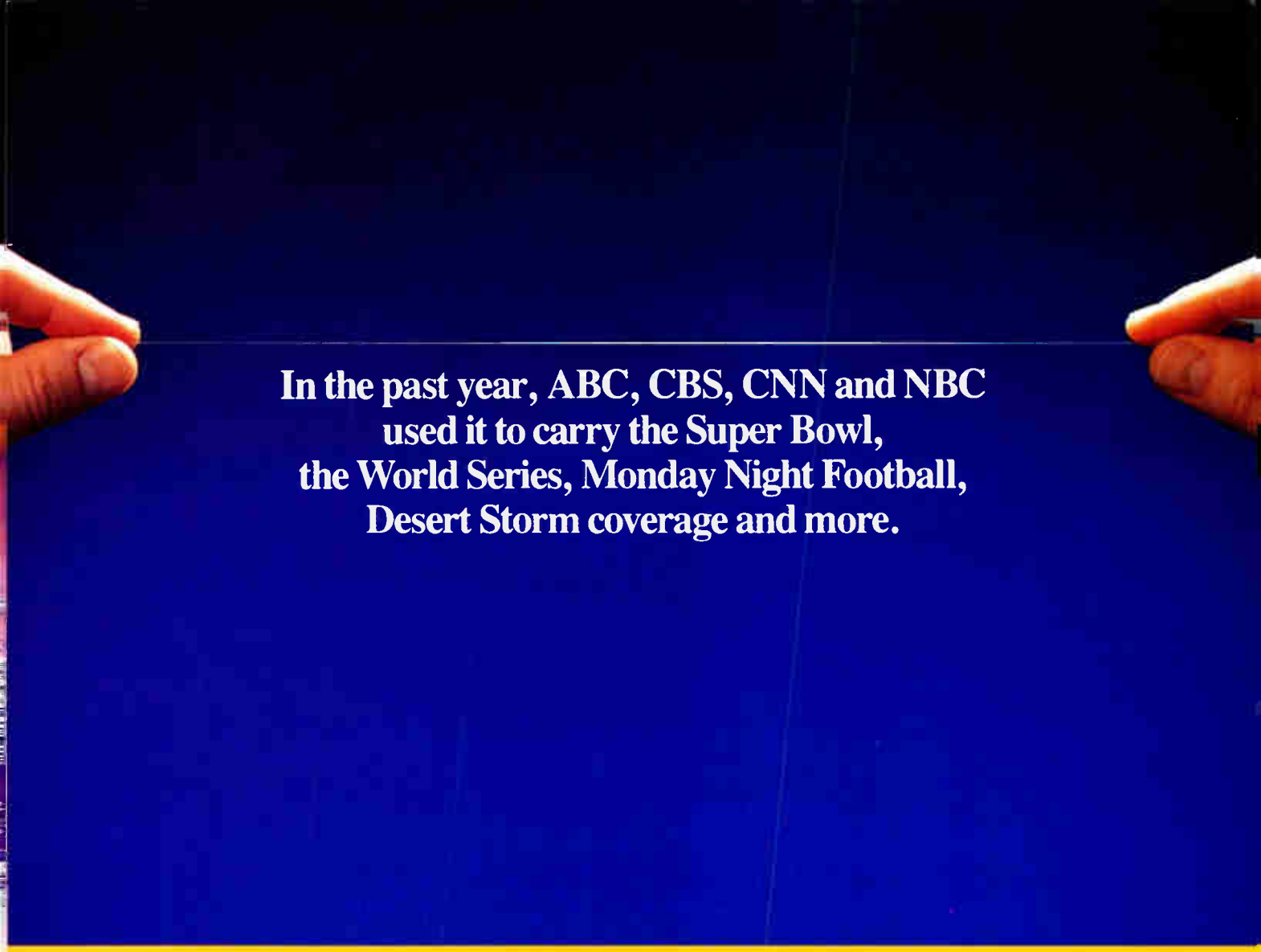
In most circumstances, sweep technicians will select an ambient temperature pad and equalizer. What happens if a 16 equalizer is selected at the ambient temperature of -20°F and the temperature rises to 120°F? The amplifier station will be under-equalized by two values and will be operating 3 dB low at 450 MHz. What happens if a 3 pad is selected? The input level will be 2 dB lower and the station will be operating 5 dB low at 450 MHz.

If the amplifier is provided a flat 10 dBmV input at -20°F, at 120°F the input would be 7 dBmV at 55 MHz and 5 dBmV at 450 MHz. What happens to the carrier-to-noise ratio and distortion characteristics when a 30 amp cascade is operating 5 dB low or in reverse conditions 5 dB high? Do you ever wonder why distortion problems are more prominent in summer and winter?

Only balance once yearly

Most manufacturers do not often provide detailed temperature compensation procedures for system balancing. The shortage of available information has made it customary for sweep technicians to balance a system twice annually in efforts to minimize system distortions and to reduce distortion-related service calls. Proper temperature compensation techniques used during system balancing and daily routine maintenance could reduce annual distortion-related service calls by 50 percent. A cable system would only need to be balanced once annually.

Temperature compensation should be used at all times to optimize system performance year-round. All system technical personnel who perform amplifier adjustments should have the proper training to introduce these techniques into daily routine maintenance and system balancing procedures. **BTB**



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Reader Service Number 53

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Ladder repair and maintenance: The missing rung

By Willis Smith
Technical Manager,
Metrovision Inc.

The cost of a ladder replacement and adherence to the Occupational Safety and Health Administration safety standards are generally areas that technical management has difficulty keeping track of. After concentrating on plant electronics, vehicles and personnel, rarely do ladders get much attention unless they are broken. Furthermore, most cable systems are not equipped or do not have the expertise to repair and maintain a fleet of ladders within stringent OSHA requirements.

Short rung cost

Typically, the primary method of ladder repair has been to purchase a new ladder. The average cost of a new ladder will range between $250 and $350 — by no means an inexpensive repair. Now let's multiply a median price of $300 by a fleet of 50 trucks with two ladders per truck (one small and one large):

Two ladders/truck = $600
50 trucks in fleet = x 50
Total fleet cost = 600 x 50 = $30,000

Long rung cost

When you also consider the life span of a fiberglass ladder that has not been maintained will be one to three years (depending on the installer/tech use), ladder replacement costs become even more significant over a 10-year period. If we use a life span of two years as an average, an entire fleet of ladders will be replaced five times during a 10-year period:

Fleet ladder cost = $30,000
Replacement interval = x 5
Cost over 10 years = 30,000 x 5 = $150,000

Proactive, professional approach

Enlisting the services of a professional ladder refurbishment company can go a long way in reducing the cost associated with ladder replacement as well as compliance with OSHA standards. A professional approach offers several advantages to system operations:

1) Routine (semi-annual) inspection of ladder operation and OSHA compliance.
2) There is normally no charge for inspections.
3) Repair cost guidelines are set when replacement vs. repair is more cost-effective.
4) Unsafe ladders are taken out of service.
5) Inspection and repair are scheduled around daily working hours.
6) Results are documented on the ladders and submitted to management in report form.

The bottom rung

Recent ladder inspection and repair at Metrovision of Prince George's County, Md., by Batavia Services Inc. made a significant impact on getting a handle on fleet ladder problems and safety. On-site work was scheduled from 3 p.m.-12 a.m. for three days during one week. Ladders were taken off trucks and brought to a warehouse for inspection and repair. After inspection, ladders that could not be repaired and ladders that were not cost-effective to repair were put out of service. A total of 62 ladders were inspected and repaired at a cost of $2,007. Six ladders had to be replaced.

The life expectancy of a properly utilized and maintained fiberglass ladder can be 10 years or more. If we look at the cost of professionally servicing 62 ladders over a 10-year period vs. the cost of simply replacing them, the cost saving is impressive:

62 ladders divided into $2,007 = $32.37
Semi-annual inspection/repair = x 2
Yearly cost per ladder = 32.37 x 2 = $64.74
Yearly cost for 62 ladders = $4,015.36
Ten-year fleet cost = $4,015.36 x 10 = $40,153.60

Since 62 ladders at $300 each would cost about $18,600 to replace, and since we decided before they would have to be replaced five times in a 10-year period, the cost over 10 years would be $93,000. Compare $40,153.60 for ladder repair to $93,000 for replacement, and the cost-effective solution is obvious.

Summary

Our ladder refurbishment efforts were so successful we decided to have our ladder racks inspected and repaired as well. Since much of the damage a ladder receives can be directly attributed to a ladder rack that is in disrepair, we felt it was important to service both.

By using a professional ladder service, a system operator or MSO can benefit on a short- and long-term basis. It is a win/win situation where the cost associated with ladder replacement can be reduced dramatically and OSHA safety guidelines can be enforced and monitored for compliance. **BTB**

The author would like to thank Ray Miller, a regional engineer with Metrovision, for his assistance in the preparation of this article.

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THE MTS-2B IS PREFERRED BY MORE TOP MSO'S THAN ANY OTHER ENCODER

Nostalgia: The Phoenician evolution

By Jud Williams
Owner, Performance Cable TV Products

I received a phone call the other day from a guy named Chet in central Florida. Chet was the first person I ever had dealings with in the cable industry and I had not been in touch with him for several years so I really enjoyed hearing from him. His system became my first repair customer, so after the conversation was over, I began thinking about the old equipment and how different it was to units in use today.

Kaiser CATV (which subsequently became Theta Com CATV and finally Texscan) had products that were in wide use during the late '60s and early '70s. The amplifiers I worked on back then were the Phoenician 22 dB series, which had a frequency capability of 54-216 MHz. They were powered by what was called a regulated cable powering unit having an output of 30 VAC at 12 amps — a ferro in today's lingo.

Transistorized amps

The interesting thing about these amplifiers was that they were completely transistorized, in contrast to the extensive use of hybrids today. Push-pull circuitry, which has the effect of canceling distortion, had not come into use yet, so that mid-band use was very limited.

Believe it or not, the trunk amplifiers had a very simple but effective automatic gain control capability. Some versions had a switchable attenuator while others had plug-ins. Each stage of the amplifier had a separate PC board so that problems were quite easy to isolate. As an example, the AGC trunk module had 12 individual boards.

Most of the amplifiers had integral DC power supplies, some of which were quite novel. These units used a voltage doubler (also called voltage multiplier) which is a scheme whereby rectifiers and electrolytic capacitors are arranged in a way that the output voltage is twice what would be expected from a traditional rectifier circuit. It somehow reminds me of climbing a ladder.

Alignment of this equipment was a task to behold. To begin with, a section of coaxial cable was needed as part of the test setup. The cable was cut to a length of 18 to 22 dB at 220 MHz. That means that a cable was cut so that at 220 MHz the loss or attenuation would be 22 dB. This length of cable would then be used in series with the module and the combination (amplifier plus cable) would be swept. The scheme was to adjust the myriad of trim pots and variable capacitors in a certain sequence so the output of the amplifier and cable was flat. No easy task. And of course, once the amplifier went back into the field and was installed, the tech would blow the whole alignment job by "tweaking" the very carefully set controls and then complain that the alignment job done on the bench was lousy! This tweaking technique was taught to each incoming tech, so the practice was perpetuated. Meanwhile, back at the bench, the struggle would go on.

Actually, the amplifiers were quite good and if the electrolytic capacitors were changed out (whenever the module was in for repair) the reliability was excellent. I have no doubt that some of these units are still in use somewhere but I sure would hate to have to repair them again because of the tedious alignment procedure.

Push-pull and AGC

The next Kaiser I worked on was the Phoenician XR Series, which it introduced to cover the range of 50-270 MHz. Talk about a tough unit to work on! The design engineers endeavored to cram as much new technology as possible into the same space occupied by the earlier amplifiers I've just described. They went big time into push-pull circuitry and sophisticated two-pilot AGC. To give you an idea of the increase in mass, the weight more than doubled for the same space. I truly believe that reliability was compromised for the sake of sophistication.

In order to repair these amplifiers, a lot of disassembly and reassembly was required. There were two amplifier stages made up of two sets of push-pull transistor circuits. These were the forerunners of the hybrids that were yet

to come. The problem with this particular series was that it was very difficult to get them back together. In other words, they were designed not to be repaired — a common mistake on the part of design engineers. The first integrated circuits appeared in these modules in the form of operational amplifiers in the AGC section. The AGC was by far the most difficult part to troubleshoot and was the most prone to failure. This particular series was comparatively short-lived and was followed by the Phoenician II trunk line amplifier housed in a diecast housing. Again, it was a real brute to work on.

Hybrids were used in these amplifiers but since they had short headers that made them oddball, availability of replacements was limited and they were prone to obsolescence. This was another common mistake on the part of design engineers.

There were several components used in these early units that were to become problems. One was the use of switches for built-in attenuators and equalizers. The contacts oxidize and intermittents would develop. Another was the 75 ohm pot used as variable attenuators and slope controls. They would gradually deteriorate and cause discontinuities. They also were very fragile.

It was interesting to think back over the years and mentally review what had taken place in the evolution of one manufacturer's product. It was especially nice to hear the voice from the past. By the way, Happy Birthday Chet. **BTB**

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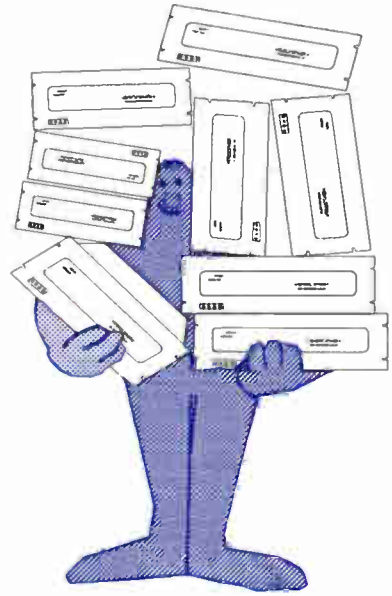

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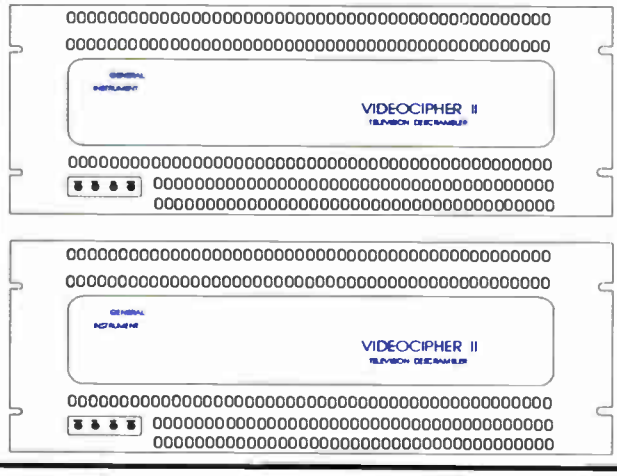

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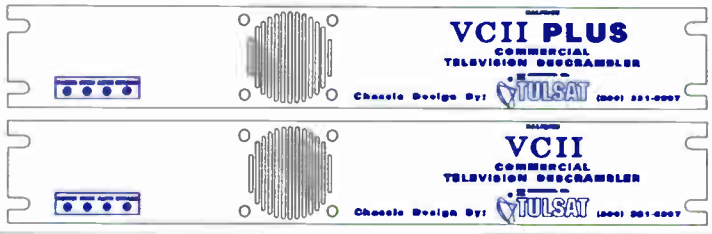

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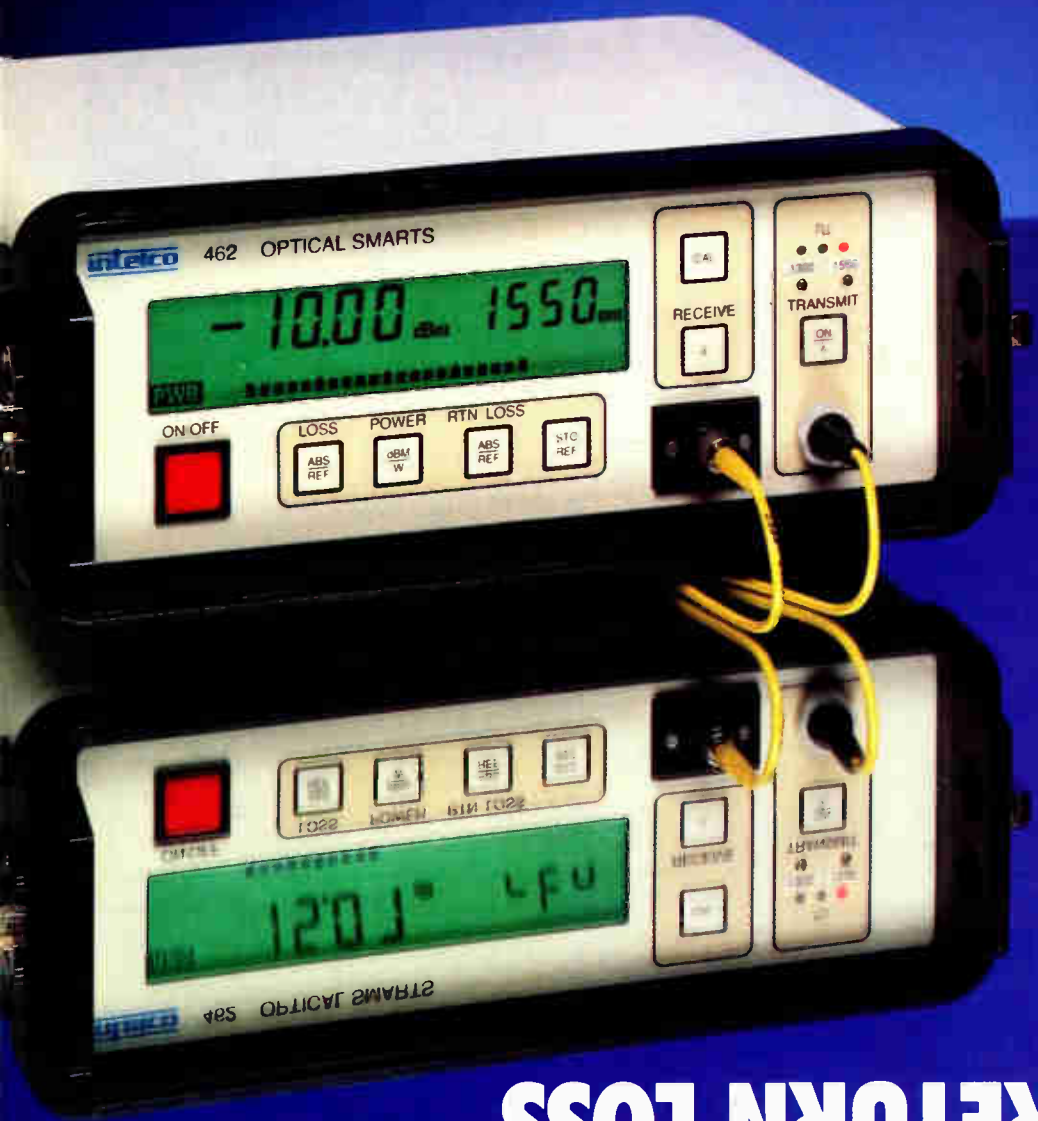

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Reader Service Number 55

Western Show Wrap-Up

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New Products from the Western Show — Anaheim, Calif., Nov. 20-22, 1991

Pioneer Demonstrates 1 GHz Converter, Rewritable Videodisc Recorder
Pioneer showed two new products, including the BA-6710C converter, which the company says is the first to reach 1 GHz in capacity. The company's rewritable videodisc recorder makes it possible to re-record over existing programming without erasing the entire disc, much like a videotape. **Reader service #208 (converter), #207 (videodisc recorder)**

Anixter Cable TV Announces Olympics Triplecast Package
Anixter Cable TV provided information on its Olympics Triplecast package designed to help participating cable operators plan and implement launch of NBC's pay-per-view Olympics. Local cable operators can contact Anixter's field personnel to review their Olympics Triplecast plans to ensure timely delivery of products needed for implementation. Products in the package include Eagle's Sideband Interdiction System and positive trapping system, as well as special pricing on S-A IRD receivers and descramblers. **Reader service #205**

Jerrold Unveils Mini-Bridger, Future System, Converters, Remote, CablePhone
Jerrold Communications introduced its Starline Model MB-550D-H dual output, hybrid mini-bridger that offers twin, power-doubled post-amplifiers, auto level control options, high efficient power supply, and a 1 GHz housing for future applications. It is positioned as a strategic component for fiber-to-the-feeder architectures and for terminating/intermediate bridger applications. The System 2000, an end-to-end look at a cable system of the 21st century, was also unveiled. The main point of the system is that it is a 1 GHz system, using Jerrold's Commander 6 line of frequency-agile modulators, Starburst fiber-optics system, Starline SX station, and Starline mini-bridgers and line extenders. Jerrold also introduced its VCRMaster converter that offers all the features of a standard Jerrold impulse-capable converter, plus the ability to record one pay channel while watching another. It is intended for multipay subscribers or those who have a pay channel and express an interest in pay-per-view. As well, the company demonstrated its Impulse 7000 Series CFT-2000 converter with an on-screen display that, when channels are changed, automatically identifies the channel number and name, whether it is parentally locked, it is a favorite channel, and if the alarm/sleep timer is on. Subscribers using the CFT-2000 have the option of changing the menu background to clear screens, partial or solid, and can center the menus. Also new was the company's Buddy Simple Remote, which can serve as a second set unit or as a primary set unit for the basic user. It has only six buttons (on/off, volume up/down/mute and channel up/down). It also has a bright yellow design and a detachable strap. Also displayed

were new products pertaining to the first three of the company's seven key areas of focus with the CablePhone. CablePhone-1 (CP-1) demonstrates the integration of cordless telephone technology in the home with the the cable converter. This includes Jerrold's Remote 'N' Phone, which integrates a cordless phone with a cable remote control and uses the telephone return path built into the company's impulse converters. CP-2 integrates wired telephony into existing cable TV networks, which includes a fiber/coax hybrid providing services over existing plant directly into the home. CP-3 uses the cable TV infrastructure to support the personal communications systems. Other key areas being explored with CablePhone are CP-4 (which encompasses "cable dial tone," allowing cable operators to provide video-on-demand); CP-5 (which takes advantage of the bandwidth available in the fiber/coax hybrid cable network to make "cable video phone" possible) and CP-6 (where a whole array of internal video information and entertainment services are provided). **Reader service #204 (mini-bridger), #203 (System 2000), #202 (converters), #201 (remote), #200 (CablePhone)**

Barco Launches Headend Monitoring System
Barco introduced its FSM 860 monitoring and supervision system for CATV headends. It is a fully programmable multistandard control instrument that scans, measures and evaluates the level and presence of modulation on all carriers in a cable network. Alarms are given when a signal or any function fails, and the unit covers the entire frequency range of 47-860 MHz. The FSM 860 allows the user to constantly check all radio, TV sound and vision signals, modulation, program and pilot carriers of all channels in a headend without any supervising personnel being involved. It also is intended for use remote from control centers where output can be loaded locally onto a printer, a PC or connected to a control center via modem. The RS232 interface can be directly connected to a suitable modem allowing remote monitoring of headends over normal telephone lines without additional telemetry equipment. **Reader service #199**

Sumitomo Introduces Air Blown Fiber System
Sumitomo Electric Fiber Optics Corp. unveiled FutureFlex, an air blown fiber system that can be utilized in applications including cable TV, LAN and campus environments. Once the cable is installed, the user has available six tubes into which bundles of fiber can be blown, as necessary. The fibers may be any type (multimode or single-mode) and the fiber bundles are available in counts of two, four, six, 12 and 18. Fiber bundles may be removed from one FutureFlex tube cable and reinstalled in another as the need for different types of fiber or fiber counts arise. **Reader service #198**

Wavetek Introduces Bench Sweep System, SLM
Wavetek introduced its Benchmark 1175 bench sweep system, which consists of a synthesized sweep source (2-1,100 MHz) and a scalar network analyzer with greater than 60 dB dynamic range. The sweep is displayed on a color super VGA monitor, and the unit features a dot matrix LCD display and soft keys. Test applications include cable insertion loss and structural return loss; amplifier gain and port impedance match; splitter, directional coupler and tap insertion loss, port-to-port isolation and return loss; and trap and diplex filter bandwidth, depth and passband characteristics. As well, Wavetek showed its new SAM 1000A, which has all the features of the SAM 1000 plus keyboard-selectable channel plans

including all U.S. channel plans and the most widely used channel plans around the world. As well, a customer-programmable channel plan with up to 100 channels with audio and video carriers can be entered into the keyboard with a few keystrokes. Also incorporated into the unit are a new meter and LCD display, both lighted to improve visibility during evening and night use. **Reader service #197 (bench sweep system), #196 (SLM)**

Channelmatic Unveils New VCR Sharing Feature
Channelmatic introduced a new feature of its Adcart random access ad insertion system — VCR sharing across multiple channels. In a demonstration, Adcart inserted local advertising on a full random access basis into two different network channels using four VCRs. The end result was output to two TV monitors in a mock living room to illustrate what the viewer sees. Additional inputs were added to the display system's configuration, including a character generator and a live-feed video camera. All switching to the various inputs and outputs was preprogrammed as part of Adcart's operating schedule, just as it would be at a typical headend. Visitors also saw the automatic compiling of four different advertising spot reels at one time by the CompEdit, the automatic insertion of local advertising into two networks from only one VCR, and multiple audio/video inputs feeding into a single insertion/playback device. **Reader service #195**

Eagle Introduces Negative, Positive Traps
Eagle Comtronics showed its new negative traps for multichannel applications. Models 8NF, 8LP and 8HP use eight poles in place of the older six-pole designs. Additional poles provide a sharper input and trailing skirts, reducing the number of unusable channels. They are available in the standard consecutively attenuated channels, low-pass and high-pass configurations. Out-of-band response is 860 MHz. Also introduced was Eagle's Model ESN-channel and Model ESD-channel traps, both with four-pole design and out-of-band response of 860 MHz. The ESN has an extremely narrow notch, tripling the number of channels that can be negatively trapped while increasing reliability and effectiveness, according to the company. Channels 2 through W may be trapped while still using the lower adjacent channel. Upper adjacent video loss also is lower. The ESD is a positive trap for use with single- or dual-jamming carrier systems. It provides a decoding filter with a very narrow notch, thereby increasing the number of secured channels up to NN, while raising the softness of present marginally decoded channels. **Reader service #194 (negative traps), #193 (positive traps)**

Harmonic Lightwaves Introduces YAGLink Optical Transmitter, Receiver, Status Monitoring
As part of its new YAGLink AM fiber-optic video transmission system, Harmonic Lightwaves displayed the HLT 6000 external modulation optical transmitter that the company says has the high power output, linearity, low noise and immunity to optical reflections for optimal AM transmissions. Each transmitter can carry up to 80 AM channels and replace four DFB laser transmitters. The design meets AM CATV requirements for CSO and CTB distortions, and uses a combination of external modulation with predistortion linearization. Installation is said to be quick and easy, requiring minimal field adjustments. The company also showed its new HLR 3000 optical receiver for use in the YAGLink system. It is compatible with fiber backbone, fiber trunk and feeder, cable area network and other architectures. The receiver

interfaces with existing coaxial-based trunk amplifiers and line extenders. It has a sensitivity close for the theoretical limit and provides linearity over a wide dynamic range. An AGC circuit maintains constant RF levels and compensates for any attenuation changes in the fiber link, and a tilt control compensates for different coax roll-off characteristics. The unit allows for street-side access and accommodates a variety of fiber cables, splices and connector types. It is available in an aluminum enclosure for outdoor strand-mount installation or in a chassis for indoor rack mounting. Harmonic Lightwaves' new status monitoring system, SMS 5000, also was introduced. It allows early detection of problems with CATV transmission. Designed for use with the YAGLink system, the PC-based system allows real-time monitoring, and control of network status and performance. Since a separate fiber is used for the return path in optical systems (like YAGLink) noise and ingress problems are eliminated. Up to 2,048 YAGLink nodes can be continuously polled for transmission problems. Status is displayed on a PC color monitor and stored. The system features a color-coded, mouse-driven, graphical user interface. Three levels of password security are provided for view, edit and control modes. It can be monitored from a remote PC via telephone line modem connection. **Reader service #192 (optical transmitter), #191 (receiver), #190 (status monitoring)**

Magnavox Introduces Digital Compression, Network Amplifiers

Magnavox CATV Systems and Philips Laboratories announced MagnaVision digital compression. It is based on open standards including CCIR 601 for studio-quality resolution, Musicam for CD-quality sound, MPEG for compression, and EuroCript for conditional access and the application of Smart Card technology. The products will be introduced in three phases: the first will increase channel capacity of each satellite transponder from a single channel to four to six compressed digital NTSC channels; the next phase will deliver compressed digital channels directly to each subscriber via specialized set-top converters; and finally the analog TV receiver will be replaced by an all-digital receiver capable of both NTSC- and HDTV-quality reception. Magnavox displayed its new Trunk Network and Global Network amplifiers as well, which are said to offer more RF power and greater reach while reducing the total number of active components required in a cable system. They are designed to fit a variety of architectures and applications, and can accommodate upgrades to as high as 1 GHz. The Trunk Network amplifier comes configured with a single trunk level output and up to two high level distribution outputs. It is designed for express feeder architectures or mini-trunking requirements. The Global Network amplifier is configured to provide up to three high level distribution outputs. It features dedicated hybrids-per-output port design. Both are equipped with a plug-in amplifier module that can be rotated in the housing so it always faces the street for easy access. A direct power port eliminates the need for a power inserter and right angle entry ports facilitate aerial, pedestal or vault mounting. **Reader service #179 (digital compression), #178 (network amplifiers)**

Contec Offers New Publications

Contec International presented two new company publications intended to inform and support cable TV system operators and their personnel. *Cablegram*, published quarterly, will

be mailed free to all interested cable operators nationwide and abroad. It will include articles on how to keep repair costs down, suggestions on what to do when lightning strikes, tips intended to help lower cable system maintenance costs and more. The company also premiered its new parts catalog, which is fully indexed and contains a comprehensive listing of the most commonly used parts in converter repairs. **Reader service #177 (*Cablegram*), #176 (catalog)**

Belden Introduces Drop Cables, Corrosion-Protected Products, Catalog
Cooper Industries' Belden Division showed a new line of 7 Series coaxial drop cables designed around the proposed SCTE specification for 7 Series cable. The new family of products includes six cables with two different shield alternatives. One shielding option is bonded aluminum/mylar/aluminum with a 61 percent braid and Belden also is offering a Duobond Plus design for maximum shield effectiveness. Both shield designs are offered in messengered, CATV-rated house drop and flooded burial configurations. All products are produced with a gas injected foam polyethylene core featuring a minimum 23 dB SRL from 5-750 MHz. Also introduced was a new line of corrosion-protected drop cables. The product offering includes six new cables with a corrosion-protectant, flame-retardant gel enabling the products to receive a CATV rating. Both RG-59 and RG-6 cables are available in a variety of shield configurations. All products are manufactured with a gas injected foam polyethylene core and a minimum SRL of 23 dB. Belden also showed its new catalog featuring 18 new drop cable products. It includes an updated and expanded technical section with detailed information on shield effectiveness. Printed on recycled paper, the catalog also features a cable-to-connector cross-reference guide with listings for Gilbert, LRC and PPC. **Reader service #175 (drop cables), #174 (corrosion-protected products), #173 (catalog)**

Sachs Announces "True Earning Program"
Sachs Communications announced it is initiating its STEP (Sachs True Earning Program) in which cable operators can earn 25 percent value on Sachs products free of charge by purchasing selected items from Sachs distributors. **Reader service #172**

ONI Debuts Cable Integrated Services Network, OTDR
Optical Networks International introduced the Cable Integrated Services Network (CISN). The CISN, developed by AT&T for the cable industry, is a 10-year plan that lets cable operators design their fiber networks with a clear vision of future technologies. Using today's fiber/coax networks as a foundation, CISN offers a broadband spectrum allocation plan for 1 GHz systems, and utilizes a building block approach for smooth transition from today's analog, RF environment to the digital world of the future. ONI's Test, Measures and Restoration Group unveiled the Model 6000 optical time domain reflectometer by Photon Kinetics that combines high resolution and long range distance measurements in one optical plug-in. The unit features a built-in thermal printer and a 3.5-inch disk drive for storage of measurement results. Measurements can be analyzed on a personal computer using the OTDR emulation software. **Reader service #171 (CISN), #170 (OTDR)**

Alpha Introduces Power Supplies
Alpha Technologies unveiled the Fiberups Series of standby power supplies, designed for

flexible powering in fiber-optic networks. The product is available with several choices of enclosure configurations appropriate for both aerial and underground installations. The Fiberups DC option provides direct DC powering of fiber-optic receiver/amplifier circuitry. The Fiberups AC version offers 60 V at 7 amps for local area standby powering suitable for use in any of the common architectures. Both versions are modular, plug-in packages that can mate with a low-profile, pole-mount cabinet containing a preconfigured battery pack. The modules also adapt to Alpha's existing ground-mount and pole-mount cabinetry, allowing use of any required battery complement. Alpha also introduced its new APC Series of 60 VAC power supplies that is aimed at the powering needs of newer cable architectures like fiber-to-the-feeder and interdiction. The units support portions of the plant that don't call for battery backup. The series is built around a flexible, universal power module assembly that adapts to a variety of mounting systems. The power assembly itself is modular, including a number of optional features and assemblies that may be installed or removed right on the pole. The modular transformer assembly may be removed or changed to a different rating by removing a single hold-down screw. An eight-amp power module is for applications down to 4 amps, while a 14-amp version handles loads down to 7 amps. Optional features include plug-in upgrades, output time delay, a 350 joule metal oxide varistor and load indicator. **Reader service #169 (Fiberups Series), #168 (APC Series)**

Siecor Introduces Crimping Device, Aerial Mount Bracket

Siecor Corp. exhibited its new Crimp & Go splice protection crimping device with its full line of M90, M91 and M92 fusion splicers. The system allows users to easily access individual 250 µm fusion-spliced fibers in a splice tray for rearrangement of the fiber-optic cable plant. It protects individual fibers in an aluminum sleeve sealed with a rubber adhesive. No heater or power supply is needed to apply the protector, and it's not necessary to preset the Crimp & Go device before splicing. Crimp parts are placed over finished splices and adhered to the fiber by closing the device's spring-loaded jaws. The protectors are compatible with the company's standard M68 and M67 splice tray series. Siecor also introduced its aerial mount bracket for the SCN-CAN and SCN-003 splice closures. The offset design of the bracket ensures that other cables can pass between the closure and messenger cable without interference. **Reader service #167 (crimping device), #166 (bracket)**

Texscan Introduces Distribution Amplifier

Texscan's Communication Products Division unveiled the Flamethrower distribution amplifier (FTDA), an addition to its family of "fiber-to-the-future" products. Also known as REX (reach extender), the FTDA provides a 1 GHz platform and is available in 35, 39, and 41 dB gain versions with optional plug-in ASG. Each has three output ports and each port is driven by its own power addition hybrid. **Reader service #165**

Electroline Introduces 1,000 MHz Electronic Multitap

Electroline Equipment exhibited its new EAS electronic multitap system, a 1,000 MHz broadband addressable system designed for outside-the-home security. It is designed for strand-mounting and is compatible with PAL, SECAM and NTSC today, transparent to future HDTV formats. The new product comes in versions featuring two, four, eight, 12 or 16 outputs. **Reader service #164**

TVC Introduces Locking Terminators
TVC Inc. presented its new locking terminators. Tools are available that work on both the TVC and Gilbert or Viewsonics terminators. **Reader service #163**

Scientific-Atlanta Introduces Simulcasting Feature for DMX
Two new Scientific-Atlanta products were unveiled at the show that will allow operators that carry the Digital Music Express digital audio service to provide up to 130 digital stereo simulcasts of cable channels including premium services and pay-per-view events. This new feature is exclusive to the DMX service. Operators will be able to simulcast MTV, HBO, Video Jukebox, Showtime or any other channel they choose. An advantage of the simulcast feature is that the audio of local ad insertions during simulcast is delivered on the DMX system. Other benefits are that simulcast channels do not reduce the 30 channels of music being carried by DMX and simulcast channel numbers on the DMX terminal can match the numbers on the subscriber's TV channel selector. **Reader service #162**

Zenith Unveils New On-Screen Display System
Zenith demonstrated a new on-screen display system that helps cable operators communicate with subscribers. The display features multicolored layered menus that look like stacked file folders on the screen. The 3-D look allows the viewer to pick any set of menus at the touch of a button on the remote control. The on-screen menus for cable decoders will allow operators to send messages to everyone in the cable system as well as customized messages to individuals within the system. It would also provide an easy-to-use pay-per-view event ordering and confirmation sequence that would better inform viewers of their options, according to the company. **Reader service #161**

Superior Electronics Introduces Tech Standards System
Superior Electronics Group announced it is packaging and making available the Tech Standards System (TSS). This package was designed to help cable operators comply with the proposed FCC technical standards. The package automates test scheduling and documentation. The TSS provides information that directly relates to the proposed technical standards, monitors the status of standby power supplies, AML hub sites, fiber-to-RF conversion, etc. **Reader service #157**

Augat Introduces New Connector Products
Augat showed its new Snap-N-Seal in-line splice connectors and ground blocks featuring positive, quad seal, no crimp snap-on installation, UV resistant plastic and O rings, and stamp coded identification. These features are said to virtually eliminate RF leakage, prevent moisture ingress and protect against harsh environments. **Reader service #156**

Moore Diversified Introduces Tags, Enclosures, Wall Plates
Moore Diversified Products showcased three new products — aluminum tags for fiber-optic cable, security enclosures for S-A interdiction gear and lockable wall plates for securing loop-through systems. The fiber-optic tags are said to prevent costly mistakes and solicit an immediate phone call in case of an accident. Each tag is permanently stamped with company name and phone number. Manufactured from heavy gauge, 100 percent aluminum, the tag

won't corrode and won't be affected by UV degradation. The interdiction security enclosure consists of a modified version of the highly secure and easy access Moore hinged double box. Its open sides allow 180° rotation of the interdiction unit's lid, providing complete access to electronics without removing the lid. It's available in three standard sizes: four-, eight- and 16-port. The lockable wall plate features heavy gauge steel construction, is designed to fit a standard electrical utility box and can be outfitted with a lock that matches your current key. It's coated with a scratch resistant powder applied polyester in antique white. **Reader service #160 (tags), #159 (enclosures), #158 (wall plates)**

C-COR and ALS Introduce AM Fiber-Optic Receiver
C-COR and American Lightwave Systems unveiled a new eight-port AM fiber-optic receiver station. Features include dual output bridger capability as well as status monitoring and an A-B switch. Its greater capacity, improved performance and added flexibility make it compatible with almost any fiber architecture, according to the company. **Reader service #154**

Control Tech Introduces Standby Power Supply for FTF
Control Technology is unveiling the Citation IV compact one-battery standby power supply designed to power the node receiver and up to four distribution amps in fiber-to-the-feeder designs. It is capable of delivering up to 4 amps of fully regulated 60 VAC power. It utilizes patented features like PWM regulation in standby mode and battery-saving Cycle Charging. Standard features include temperature-regulated cycle charging, self-test diagnostics, battery overcharge alarm, short-circuit proof, input transient and surge protection, auxiliary generator input, and modular construction. **Reader service #153**

Leaming Industries Demos Improved BTSC Stereo Generator
An improved Model MTS-4 BTSC stereo generator was displayed by Leaming Industries. The unit is now self-powered and up to three of the units may be racked into 1-3/4 inches of rack space. **Reader service #152**

Ipitek Premiers Digital Video Transmission System
The new Imtran Pro-Quad digital video system was introduced by Ipitek. The system uses the company's proprietary TOPLINC and PARSEC products to create a system that can carry four RS250C short haul video signals, 16 audio channels and RS232 data for signaling or control over one single-mode fiber. The system is reported to be suitable for point-to-point communications for broadcast, video conferencing, distance learning, CCTV and security applications. The system uses digital technology to transport the video(s), stereo audio(s) and data signals so they may be transported and repeated over great distances with no degradation in signal quality, according to the company. The plug-in modules are mounted in the company's standard FiberTrunk housing and therefore can be mixed and matched with Ipitek's entire digital transmission equipment family. **Reader service #151**

Nexus Introduces Distribution Amps
Nexus introduced its latest broadband cable distribution amplifier, the ASL-2000. It is a 40-860 MHz broadband amplifier offering 35 dB gain and continuously variable slope and gain controls. No plug-in slope, equalizers or gain attenuators are necessary. **Reader service #150**

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5	24	43	62	81	100	119	138	157	176	195
6	25	44	63	82	101	120	139	158	177	196
7	26	45	64	83	102	121	140	159	178	197
8	27	46	65	84	103	122	141	160	179	198
9	28	47	66	85	104	123	142	161	180	199
10	29	48	67	86	105	124	143	162	181	200
11	30	49	68	87	106	125	144	163	182	201
12	31	50	69	88	107	126	145	164	183	202
13	32	51	70	89	108	127	146	165	184	203
14	33	52	71	90	109	128	147	166	185	204
15	34	53	72	91	110	129	148	167	186	205
16	35	54	73	92	111	130	149	168	187	206
17	36	55	74	93	112	131	150	169	188	207
18	37	56	75	94	113	132	151	170	189	208

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3	22	41	60	79	98	117	136	155	174	193
4	23	42	61	80	99	118	137	156	175	194
5	24	43	62	81	100	119	138	157	176	195
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7	26	45	64	83	102	121	140	159	178	197
8	27	46	65	84	103	122	141	160	179	198
9	28	47	66	85	104	123	142	161	180	199
10	29	48	67	86	105	124	143	162	181	200
11	30	49	68	87	106	125	144	163	182	201
12	31	50	69	88	107	126	145	164	183	202
13	32	51	70	89	108	127	146	165	184	203
14	33	52	71	90	109	128	147	166	185	204
15	34	53	72	91	110	129	148	167	186	205
16	35	54	73	92	111	130	149	168	187	206
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AD INDEX

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EXFO's FOT-92XE fiber-optic test set

By Ron Hranac
Senior Technical Editor

As the use of fiber optics increases in CATV, so too has the availability of low to moderately priced test and maintenance equipment. While more expensive pieces such as optical time domain reflectometers (OTDRs) and fusion splicers have their place in a system using fiber, so does equipment that is equally important but doesn't necessarily carry a high price tag.

This latter category includes fiber-optic talk sets, power meters, fiber identifiers, precision cleavers and similar instruments. Of these, the power meter is an important part of the fiber toolbox since it allows quantifying a variety of operating parameters at the time the fiber is installed, is useful for ongoing preventive maintenance, and also helps in troubleshooting problems after the system is up and running.

Manufacturers now have available low-cost hand-held optical power meters that in some cases are available with optional LED or laser sources. Some of these hand-held instruments are quite powerful; the microprocessor has endowed them with multiple memories for storing data gathered in the field in addition to the capability to interface with your desktop PC.

One such product is the subject of this month's lab report. EXFO, a Canadian manufacturer of fiber test equipment, has a line of hand-held fiber-optic power meters. We obtained one of its FOT-92XE meters and put it through its paces in the lab.

The EXFO FOT-92XE fiber-optic test set is part of the company's FOT-90 series of fiber test sets.

The product

This unit is part of EXFO's FOT-90 series fiber-optic test sets (see the accompanying photograph). The basic test instruments themselves are housed in small plastic cases that are about the size of a hand-held digital multimeter, measuring 7-3/4 (H) x 4 (W) x 1-3/4 inches (D). It weighs approximately 1-1/2 pounds. Variations in models are a function of the type of optical detector desired (silicon, germanium or InGaAs); whether an optional LED or laser source is included; number of memories desired; and availability of the RS-232 interface.

The FOT-92XE test set we evaluated included a power meter, instruction manual, AC adapter/charger, serial interface cable for connection to a PC, one fiber-optic connector adapter (chosen by the customer when a unit is ordered), certificate of calibration, two 5-1/4 inch software diskettes, and a handy padded carrying case to put it all in.

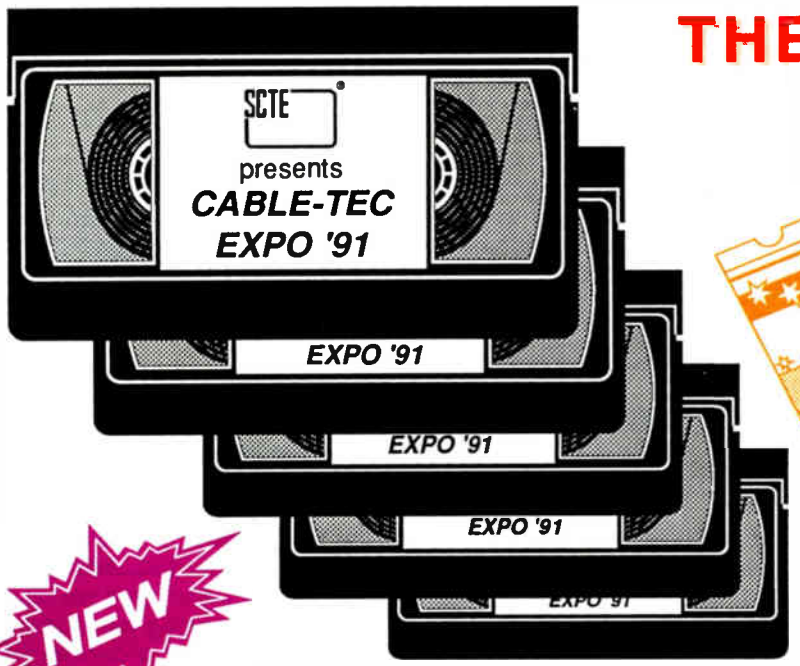
This particular model has a germanium detector; the RS-232 interface; non-volatile memories for up to 500 readings that can be stored by the user during routine operation, in addition to memories for 300 readings that can be stored automatically in the data acquisition mode; and factory calibration for 20 different wavelengths between 800 and 1,800 nanometers. The "X" in the model number indicates expanded upper measurement range. Instead of the normal -73 to +3 dBm capability, the X series can measure -55 to +15 dBm. Our evaluation unit was not equipped with the optional optical source.

Operating power is provided by factory-installed NiCad batteries that are rated to provide up to 10 hours of operation for the power meter before it becomes necessary to recharge them. If the LED or laser source has been included in the meter, then the operating time is specified as three hours of continuous optical source usage. Measurement accuracy is specified at 0.2 dB, with ±0.01 dB resolution. Table 1 summarizes the manufacturer's published specs for the FOT-92XE.

The meter's front panel includes a rectangular liquid crystal display that shows the user the optical power being measured (in dBm, mW, µW, or nW), battery condition, whether or not the internal batteries are being charged, wavelength being measured, whether or not the meter has recently been calibrated, and memory and data register information. Six front panel push buttons (the manufacturer calls them "keys") are used to control all of the meter's major functions. The figure on page 92 highlights the front panel features. →

Table 1: FOT92-XE specifications

Sensor type	Germanium
Measuring range (dBm)	+15 to -55
Accuracy (dB)	0.2
Accuracy (percent)	5
Resolution (dB)	±0.01
Linearity (dB)	±0.02
Spectral range (nm)	800 to 1,800
Size (inches)	7-3/4 x 4 x 1-3/4
Weight (pounds)	1-1/2
Power	Internal NiCad batteries
Operation (power meter)	10 hours
Operation (source)	3 hours
Environment (operation)	-10 to +40°C



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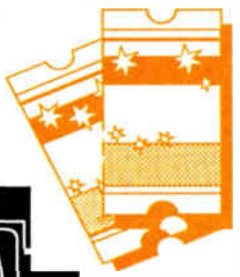

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TECH SUPERVISOR-10K subs, KS loc, $32K
DIST TECH-22 towns, MW loc, $32K
TECH MGR-70K subs, S CA loc, $50's
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DIR OF OPS-CA loc, $50's
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PRESIDENT'S MESSAGE

Board approves title changes for Society's leadership

By Wendell Woody,
President, Society of Cable Television Engineers

At its meeting held Nov. 19 in conjunction with the Western Show, the SCTE board of directors voted overwhelmingly in favor of recommending to the Society's members a change to the SCTE bylaws that would elevate the position of SCTE president to that of chairman of the board. This position would be elected by the directors, each of whom represent his or her general membership constituents. The title of chairman is already used by many of the Society's 70 chapters and meeting groups in their organizational structure and bylaws.

Chairman

When the current position of Society president becomes known as chairman, the title of president will be used by the Society's employed staff. This action will elevate the current executive vice president to the position of president.

Following the completion of my term as SCTE president at Cable-Tec Expo '92, to be held June 14-17 in San Antonio, Texas, the new elected leader of the Society will be recognized as the chairman.

This recommended reorganization will give the Society a more businesslike structure. The board recognizes the need for this evolution due to the Society's continuing growth in terms of general membership, industry support, international recognition, growth of the SCTE professional staff and the vast expansion of membership programs.

This referendum vote will be presented to the SCTE membership during its annual election process to fill open seats on the board of directors. The general membership will vote according to the procedures to be followed when a bylaw change is mandated.

Improved structure

The new structure also will advance the current positions of eastern and western vice presidents to eastern and western vice chairmen. The title of vice president will be reserved for positions within the Society's employed staff when deemed appropriate. I believe that the titles of chairman and vice chairman will better reflect the actual positions of the elected board members who serve in these offices on a voluntary basis.

Industry movement

Many organizations in our industry currently recognize the chairman as their top elected office. The National Cable Television Association (NCTA), Community Antenna Television Association (CATA) and Cable Television Administration and Marketing Society (CTAM) are among the entities that presently utilize this structure. In addition, the state cable TV associations for California, Florida, Illinois, New England, Pennsylvania, Texas and the Cable Television Association of Maryland, Delaware and the District of Columbia also operate under this structure.

Vote! Vote! Vote!

It is once again time for SCTE's annual election. In order to maintain continuity on the board of directors, only one-half of the regions elect new directors each year. This year's elections are being held for Regions 3, 4, 5, 7, 8, 10, 12 and one at-large director. Your election package will contain a biography of each candidate. It is shameful to report that only one-third of the national members bothered to vote last year. Your contribution to this industry is made by exercising your voting rights in the election of strong, qualified leaders for the Society. *Please vote!*

Meeting the members

It was with pride and pleasure that

"Your contribution to this industry is made by exercising your voting rights in the election of strong, qualified leaders for the Society."

Region 1 Director Tom Elliott and I elevated the San Diego Meeting Group to chapter status at the Western Cable Show in Anaheim, Calif. Officers present from the chapter included Jack Connolly, Russ Bottjer, Dave Bourne, Kathy Horst, Tony Jones and Adolph Kuhn. We would like to express our special thanks to the Western Show SCTE Technical Program Subcommittee: Jack Connolly, Tom Elliott, Mark Harrigan, Harold Mackey and Terry Mast. **CT**

(Editor's note: For more on the Western Show, see the "News" section beginning on page 10 for coverage of announcements and SCTE-sponsored tech sessions, and the "CT Daily" starting on page 79 for a wrap-up of new products introduced. For more on the proposed title changes, see "Letters to the Editor" on page 9 and "SCTE News" on page 20.)

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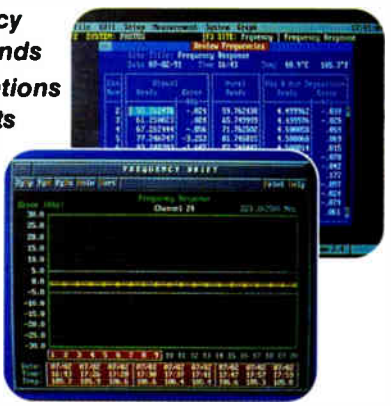

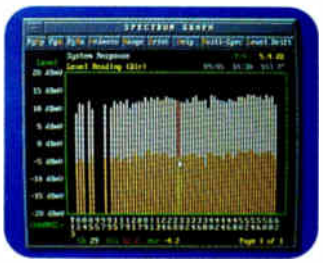

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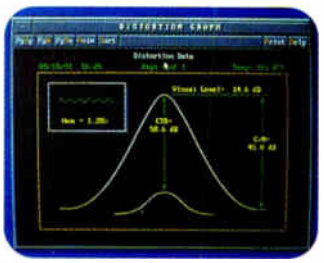

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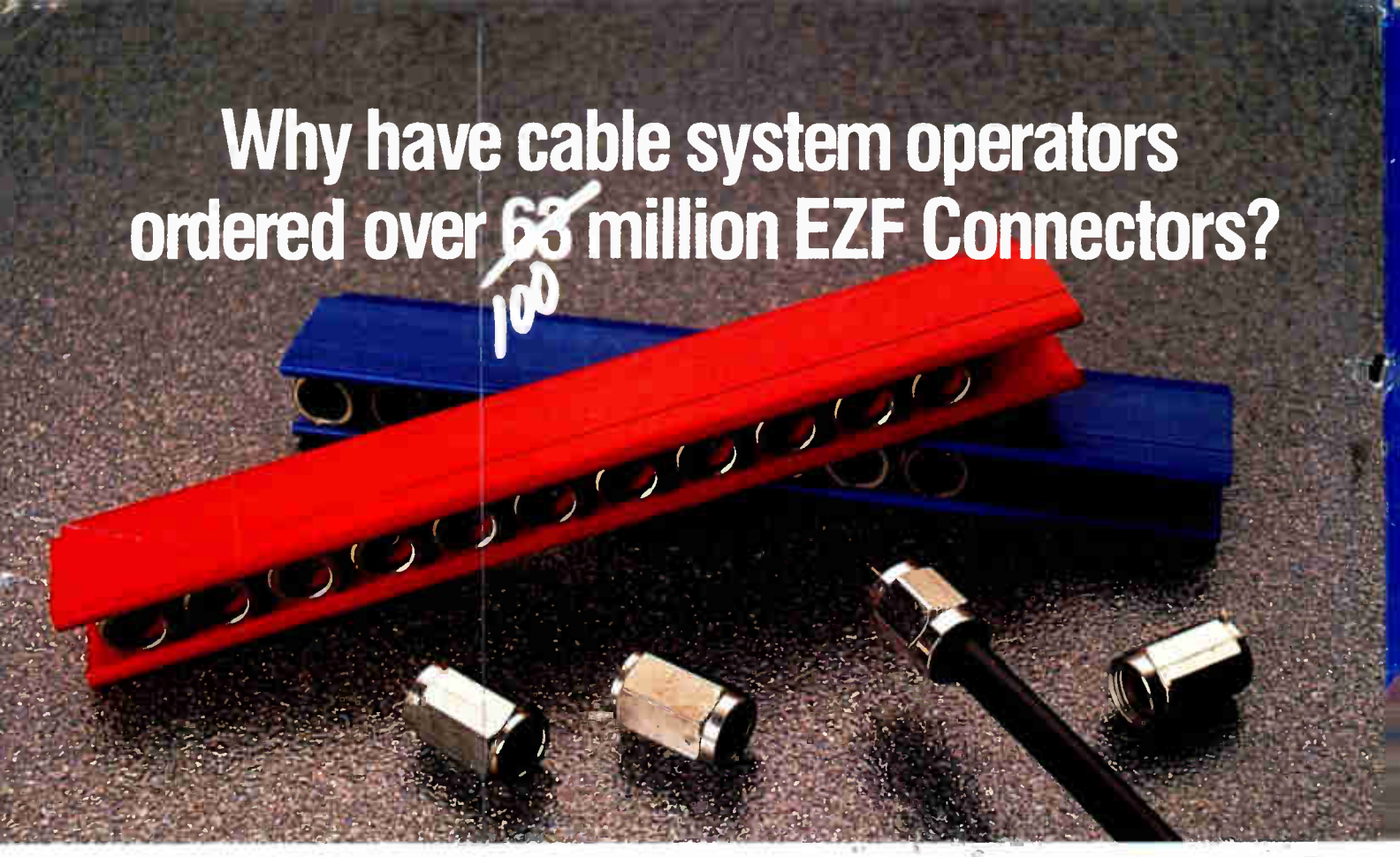

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