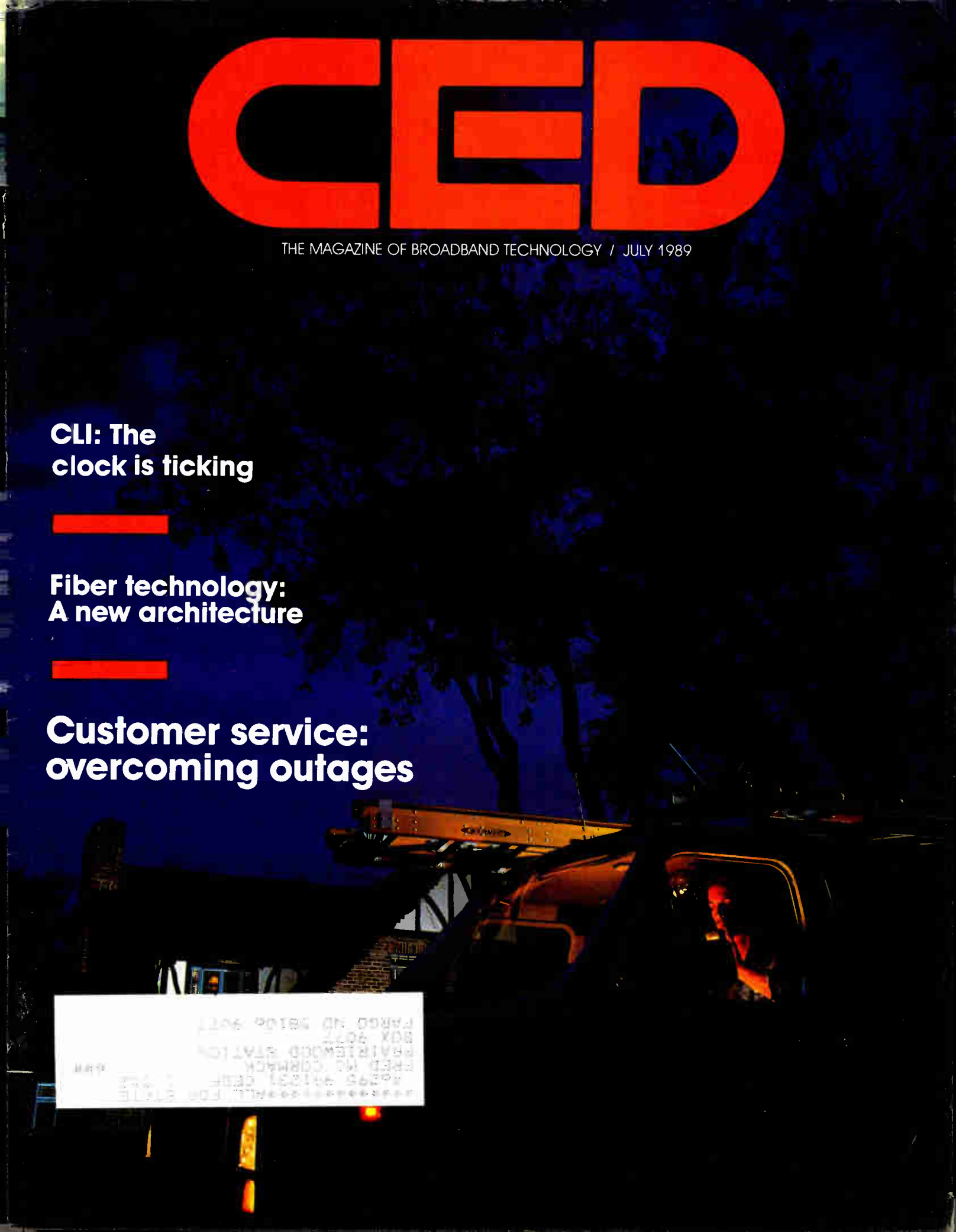
CED

THE MAGAZINE OF BROADBAND TECHNOLOGY / JULY 1989

CLI: The clock is ticking

Fiber technology: A new architecture

Customer service: overcoming outages



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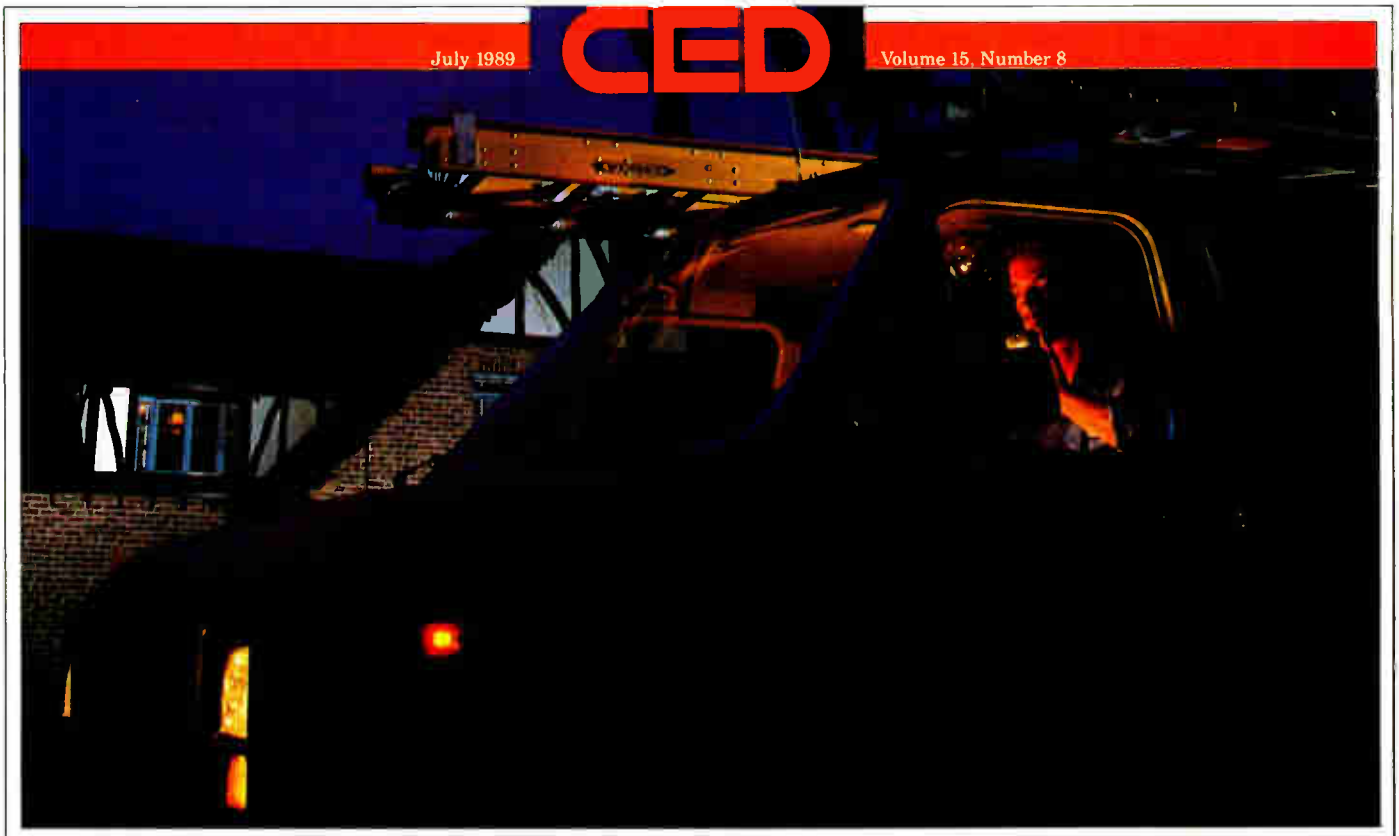
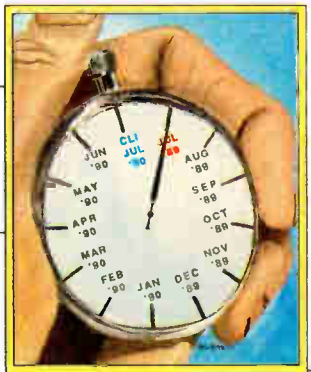
July 1989 CED Volume 15, Number 8



About the Cover:
Outage reporting and response time is increasingly important in the cable environment. How to improve this aspect of customer service is the topic of the feature story on page 24. Photo by Ken Paul, Sunlit Ltd.

CLI COMPLIANCE



One year and counting until CLI requirements must be met.

DEPARTMENTS

CED. (USPS 330-510) (ISSN 1044-2871) is published monthly except twice in May by International Thomson Communications Inc., 600 S. Cherry St., Denver, CO 80222. ©July 1989, Volume 15, Number 8. Subscriptions free to qualified industry readers. All other one-year subscriptions are $36, prepaid in U.S. funds only. Second-class postage paid at Denver, CO. and additional mailing offices. CED is published on behalf of the cable television and broadband communications industries. POSTMASTER: Please send address changes to CED Circulation, 600 S. Cherry St., Suite 400, Denver, CO 80222. MEMBERS OF THE BPA.

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Reader Service Number 3

VISION

incent Van Gogh
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During his lifetime, Vincent Van Gogh's quest to duplicate nature's emotional intensity and striking beauty through the bold and intense use of color was dismissed as madness by all but a few.

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Van Gogh's secret was deceptively simple. Use the paint right from the tube. Don't muddy or dilute the color. Lavish the canvas with color the way Mother Nature lavishes color on a sunflower. In sum...live, paint and create from the heart.

Today, there are artists who work on a technological canvas. One with its own tubes of color built right in. But for the "Van Goghs" of television, Mother Nature's true beauty is often muddied by the limitations of the system used to bring artist and audience together.

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CABLEOPTICS
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GENERAL INSTRUMENT

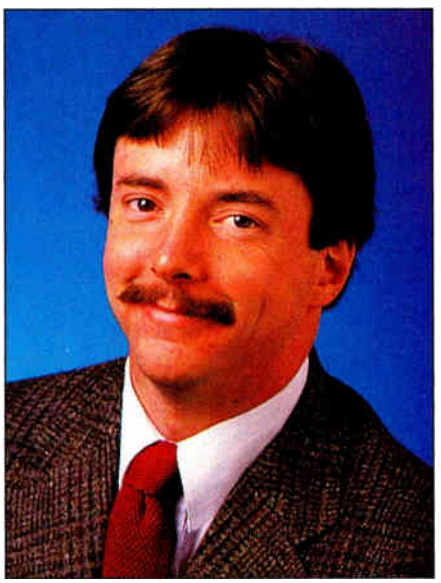
Reader Service Number 4

Philadelphia Museum Of Art: Mr. & Mrs. Carroll S. Tyson Collection

Pulling the reins on technology's advance

With all of the confusion surrounding advanced television—it's costs, the testing hurdles that have to be cleared and the eventual format it may take, the last thing this industry needs now is a separate voice urging restraint and a completely different course of action.

We all know the Japanese have been working on advanced TV for years and their track record for bringing products to market in a timely manner is unparalleled. The ability of Sony, JVC and others to market state-of-the-art, whiz-bang consumer electronics to the American public is an example of marketing prowess unequaled elsewhere.



If American companies and CATV operators don't compete with—or even defeat—these interests, a high price will have to be paid. Once high-resolution, wide aspect ratio pictures are available, either on videotape, discs or other media, Americans are going to buy them if for no other reason than to say they were the first to have it. So it's important for competitive reasons that cable is able to offer similar, or better, pictures.

But that isn't how Tele-communications Inc. sees it. The largest cable operator in the land has instead embraced the idea of offering improved NTSC pictures and asking its subscribers to wait until 2000 or so when "processed digital" television is developed.

The idea, on paper, is a good one—but appears flawed when examined realistically. By utilizing comparatively low-cost Faroudja (and perhaps other) technologies that essentially double the number of lines and eliminate a host of NTSC artifacts, the cable industry could offer significantly better pictures without forcing television manufacturers to re-tool, asking consumers to spend thousands on new equipment or changing video transmission standards.

The danger is in asking technology to pause because it makes sense on Wall Street. Americans are in love with technology and may very well decide that a picture tube with a 16-by-9 aspect ratio is what they want. Should the cable industry sit idly by and watch its competition make even deeper inroads in the living rooms of America? The industry has come much too far to succumb to erosion of penetration so soon after clearing the 50 percent benchmark.

It's even more dangerous to put all your eggs in one, unproven basket. Processed digital television, how ever it is defined, cannot be done—today. And while it can be embarassing to say something won't work and never will (remember all the experts who said AM on fiber couldn't be done?), there is some question that full-motion video could ever be compressed enough to fit in a 6-MHz channel.

Just because it makes good business sense to stay with NTSC for now doesn't mean consumers will buy off on the idea. It may take years for HDTV to gain a toehold in the market (and if so, we'll all be watching NTSC receivers for at least the next decade), but simply ignoring HDTV and hoping it will go away isn't realistic. If TCI is convinced it's right, it should proceed with its plan and see if it comes out the "winner."

Roger Brown
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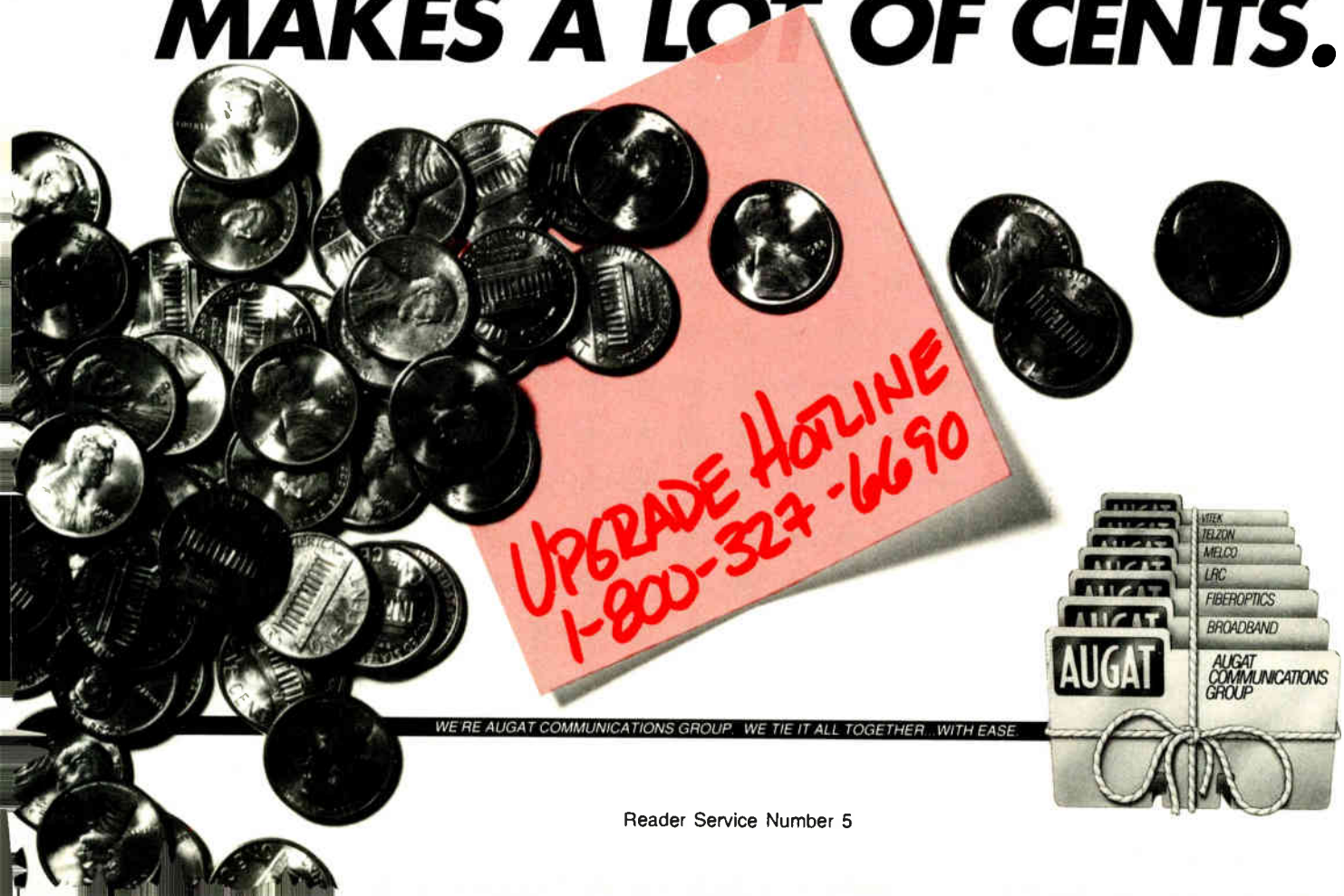


Reader Service Number 5

COLOR BURSTS

Catel, telco team in fiber project

Fiber-to-the-home trials aren't new, but when a CATV vendor gets involved, the industry needs to take notice. **Catel Telecommunications** and **Reliance Comm/Tec Corporation** have announced a working partnership whereby a family of fiber-to-the-home (FTTH) products will be developed.

Two field tests involving about 100 to 150 homes each and lasting six months to a year will be announced soon, according to Richard Green, vice president of marketing for Catel.

Those tests will involve the placement of video, POTS (plain old telephone service) and data on fiber cable and delivering those signals to tap locations that serve four homes. At the tap, video will be converted to RF on coaxial cable while POTS and data would be sent over twisted pair. Each home would have two telephone lines available.

According to Green, the likely scenario is that FM video signals will emanate from a cable system's headend and be transported over fiber to the telephone company's central office. From there, video will be converted to AM and sent over fiber to controlled environment vaults (CEVs) and then repeated to the tap location (See Figure 1).

In related news, Catel is preparing to deliver its Transhub III units to Jones Intercable for the MSO's fiber optic build in Broward County. However, Catel has abandoned its plans to use Fabry-Perot lasers, opting instead to go with distributed feedback types, which most other AM fiber systems also rely on for better performance specs. Jones' specs for the TransHub III were 50 dB signal-to-noise (with 11 dB of attenuation).

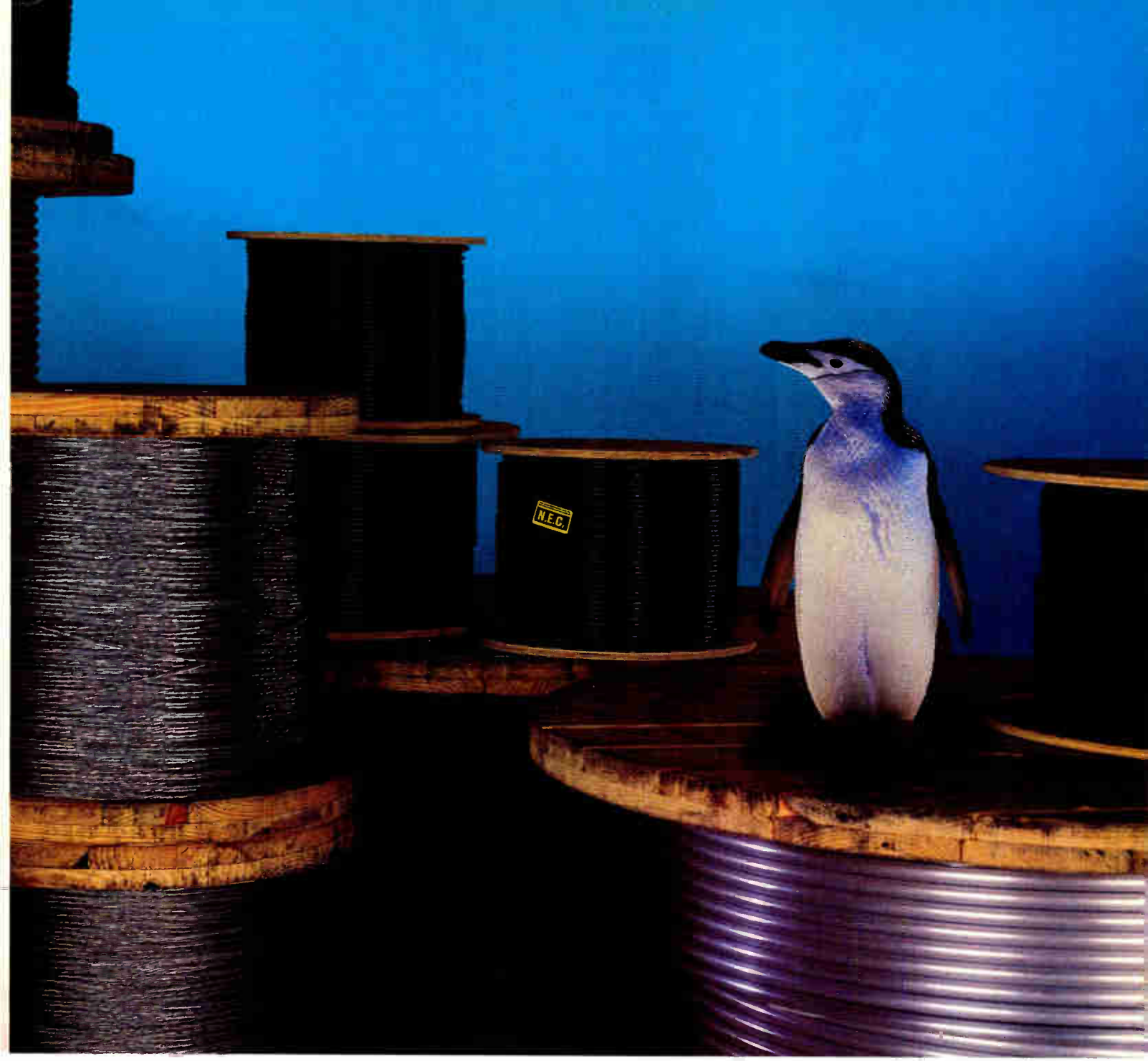
Production of the TransHub III units has "progressed well," said Dr. James Hood, president of Catel. The units now meet Jones' specs "with a reasonable amount of margin" and are truly produceable in volume, he said.

Catel also made an engineering compromise in its TransHub I FM-to-AM unit by isolating the FM demodulation and AM modulation functions on different plug-in cards. According to Hood, the technology could be made to work, but the cards weren't able to be manufactured cost-effectively. So, instead of being able to house eight channels in a single shelf, there will be room for only four channels.

And finally, some new products on the horizon for Catel. A new version of Catel's scrambling unit, which will work in sync suppression systems, is presently in the breadboard stage undergoing testing. The company is anticipating introduction of that product by the Western Show in Anaheim this year. Also, a new AM system was scheduled to be offered during the SCTE Show in Orlando last month. The high-performance system will deliver 54 channels over three fibers and offer 52 dB S/N with 7.5 dB path loss. "This system is designed for operators who want to limit amp cascades but can't get them down to four, five or even eight (amps)," said Hood.

Faroudja tests gain support of b'casters

Yves **Faroudja**'s SuperNTSC enhanced definition television system has gained the attention of four major broadcast-



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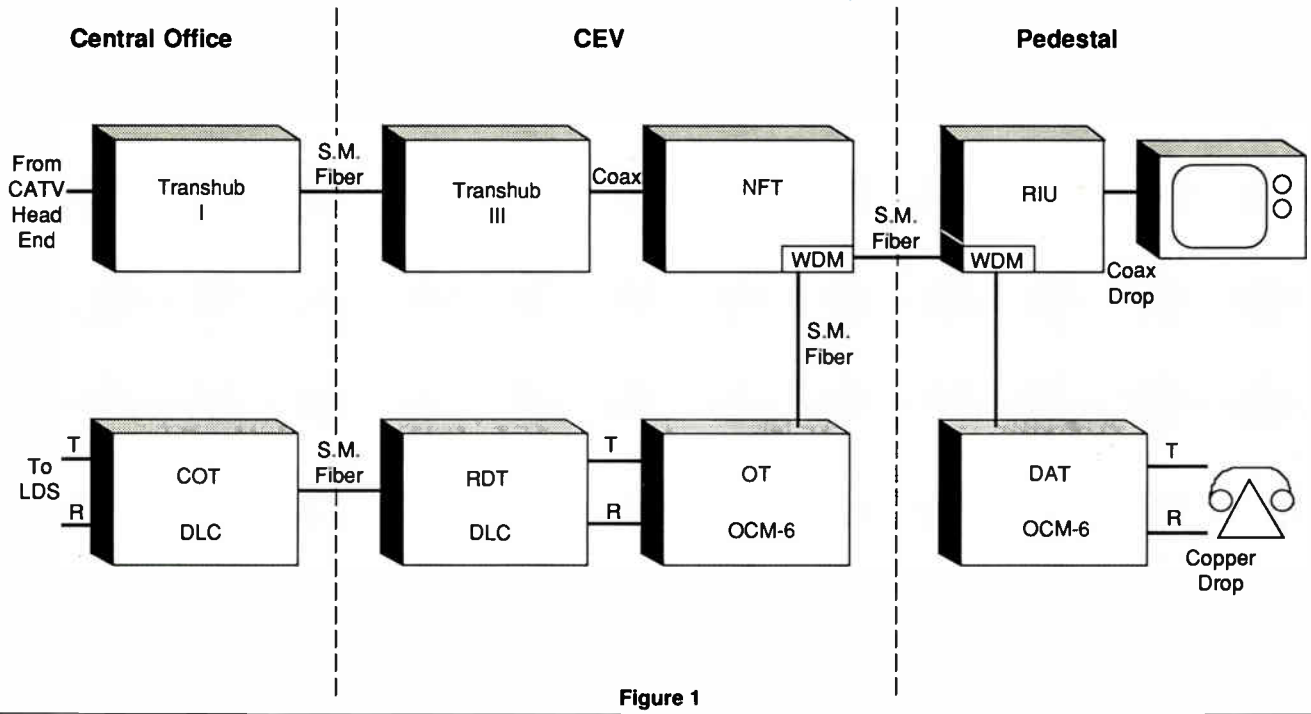

Figure 1

Combined Service—Telco and CATV operator "fiber to the tap."

ers, Tele-communications Inc. and other cable system operators around the country who plan to field test the system over the next two years.

NBC, Tribune Broadcasting, Westinghouse and Capital Cities/ABC plan to perform 10 or 12 tests; the first of which may be in Pittsburgh, where Group W owns a television station and TCI is heavily concentrated. Regularly scheduled programming of perhaps a few hours per week are envisioned. That programming would be shipped over cable to special receivers located in public gathering locations like shopping malls.

Cooperation needed

Now that TCI has gained support from the broadcasters, it is looking for cooperation from other MSOs. According to John Sie, TCI's senior vice president, those fellow cable operators should be on board soon.

The tests are part of TCI's overall strategy to implement improved NTSC, stall the establishment of non-NTSC compatible advanced television systems and instead develop a digital 6-MHz system by the year 2000. Faroudja's system, which consists of pre-transmission comb filtering and line doubling techniques, will require new television receivers for consumers to see all the improvements. However, those receivers would be priced significantly less than HDTV receivers.

The panel announcement concerning the field tests was actually held 12 miles away from the Dallas convention center at Heritage's headend, where Sie, Faroudja, and the broadcasting representatives were tied in via fiber optic link. During the announcement, Faroudja demonstrated his system on a large screen.

ALS wins contract for Toronto upgrade

American Lightwave Systems has been chosen by Rogers Cablesystems of Canada to supply approximately $5 million of fiber optic electronics, status monitoring and control software for Roger's massive upgrade of the Toronto system. Adcom, ALS' Canadian distributor, will provide system integration of hardware, including optics and switching systems and additional control software.

Under the contract agreement, ALS FM gear will be used to feed six primary hubs, while AM gear will be used to transport signals from the primary hubs to 51 secondary hub sites. Amplifier cascades will be limited to no more than 10 when the upgrade is finished in 1993. The Rogers architecture is fully redundant and automatic hot standby switching will occur in case of outages (for a detailed description of the Rogers architecture, see the feature elsewhere in this issue).

High signal quality is a feature of the Rogers architecture. According to John Holobinko, vice president of marketing and sales at ALS, delivered signal quality to primary hubs will exceed 60 dB signal-to-noise and the reverse path will meet RS-250B short-haul specs (67 dB) from every location to monitor signal performance at every point in the system.

Also, ALS is quoting new performance specifications for its LiteAMp 1300 system, an AM fiber product. With a 9 dB loss budget, users could expect to transport 42 channels of video and see 52 dB C/N, -62 composite second order, -65 composite triple beat and -62 dB cross mod. ■

—Roger Brown

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Lemuel Tarshis

Making change happen

After 13 years with one company, most people can give you a long list of experiences gained while there. But Lemuel Tarshis, vice president and general manager for Jerrold Distribution Systems division, sums his lengthy stay with General Electric quite simply. "One of the most important things I gained was management capabilities," says Tarshis. "The knowledge that I wanted to be a manager, and two, the ability to practice that art."

After getting his Ph.D. from Stanford University, Tarshis went to work for GE in corporate research and development (R&D). The organizations Tarshis managed were involved in everything from superconductivity to consumer products like housewares and major appliances. Approximately seven years later, Tarshis went to the lamp division where he had both advanced engineering and project management responsibilities.

"The ability to take a product concept or product from concept into manufacturing," was another skill Tarshis felt he acquired while at GE. This ability demonstrated itself in some of the very successful products that were introduced such as the Polaroid SX camera and the flip flash that went into all of Kodaks non-electronic flash cameras. From here, Tarshis went to housewares and helped develop, patent and put into manufacture the first low-cost smoke alarm. In the mid '70s, Tarshis introduced electronic controls for appliances. "I had the good fortune to work with major appliance people in developing electronics," says Tarshis.

'Watching' and learning

In 1980, Tarshis had the opportunity to get out of technical management and into general management with Timex Corp. "This was an opportunity to manage not only engineering but manufacturing and marketing and more general management," says Tarshis. "So I looked at that as a real challenge. That's where I wet my teeth on manufacturing management." One contribution Tarshis claims a good deal of responsibility for is technologically taking Timex from the mechanical watch days into the electronics world. "That was a big step for Timex because they had such an ingrained mechanical watch technology. Everything had to change, even the marketing."

This change contributed another aspect to Tarshis' portfolio—marketing. According to Tarshis, to understand what the customer wants and provide a technological product, "you have to provide a product that the customer wants to buy." Armed with this thought, Tarshis moved into the cable world in 1984 as vice president and general manager of the Communications Systems division of Times Fiber Communications.

At Times Fiber, Tarshis' primary responsibility was to grow a newly created division for a cable distribution product called Mini Hub. Seeing it as an opportunity to get back into higher technology, things were going well until there was a leveraged buyout at Times Fiber. Because General Instrument had contacted Tarshis several weeks earlier, Tarshis saw the buyout as an opportune time to recontact General Instrument.

Sitting the bench

When General Instrument originally contacted Tarshis, it was with one of several general management positions in mind. When none of the positions worked out for various reasons, Tarshis was offered the position of corporate vice president of technology and planning. The way Tarshis describes the new position with General Instrument was "a bench position" until an appropriate general managers job opened. The first one that was appropriate was the Jerrold distribution division.

"That gave me the opportunity to get back to a business I really had grown to love," he says. Tarshis sees the current status of the distribution business as having gone from somewhat of a "commodity orientation maybe 18 months ago to a very dynamic, growth oriented segment of the CATV market." Tarshis not only sees Jerrold as a phenomenal organization, he sees his position as "having all the elements of what I like to do," says Tarshis. "That is running a somewhat mature, strong business and at the same time being able to grow it."

According to Tarshis, that growth can be seen in the form of fiber optics and the potential of increased bandwidth. The driving forces behind this expanded bandwidth are threefold says Tarshis: high definition television, fiber optics and the threat of a telco incursion into cable.

The promise of more

To Tarshis, one of the larger pushes behind expanded bandwidth is the telco promise of more bandwidth for voice, data and video on the same fiber. Because the amount of information that's involved in voice is so small that you don't need fiber for voice, Tarshis wonders "how high is really high with regard to bandwidth? If we had the capability to expand bandwidth out to 750 MHz or 1 GHz at maximum, not put it in, but have the capability to do it" says Tarshis, "that's all the cable industry really needs."

Regardless of the telco threat, Tarshis is moving in the direction of continually pushing to help evolve fiber into cable television. To him, the operative word is 'evolve.' "I want to put fiber out where it belongs," says Tarshis. "Where the cable operators are understanding it really belongs, in a reliable way."

In the meantime, Tarshis is at home managing in a high technology environment. According to Tarshis, the most fasinating thing about his position is "watching change and making change happen—it's the growth, the aspect of newness, the aspect of change. And then I love watching people respond to it," says Tarshis. "It becomes a very refreshing, inspiring world to be in when those things happen." ■

—Kathy Berlin

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Reader Service Number 8

So many questions so few answers

About a year ago I moved into a new home. Although the home was in the same neighborhood I've lived in for the last twelve years, I still had many new things to learn and do in this area, and as a long time homeowner I knew how to go about it. Not too long ago a co-worker moved into their first home (a house as opposed to an apartment) and after several weeks they confided in me that they didn't know what they would have done if they had not stumbled upon a neighborhood hardware store. In fact, they were rather amazed at how often they had been there since they moved into their new house—roughly once a week.

I laughed and pointed out that any homeowner would have been pleased to tell them that the local hardware store would be their stop on virtually every Saturday and Sunday for as long as they lived there. It seems that modern home ownership can't get by without a hardware store, which brings me to the point of my story.

Depending on employees

I decided to build a woodworking workshop in my new house and found myself seeking a hardware store that specialized in lumber and woodworking equipment. While discussing the work benches, shelves and storage devices that I wanted to construct with one of the employees at a specialty hardware store, I slowly came to realize how much I counted on the level of service and expertise that this employee brought to the job.

Later, when I had time to reflect, I thought about how it used to be in the hardware store business, when every employee knew about each tool and device in the store. Oh, sure, one might be more knowledgeable on woodworking tools while another was an expert on lumber but all were extremely knowledgeable and helpful about their business.

An interesting sidelight here is that the modern chain hardware stores (the Washington, DC area has several) aren't bad in this regard either. Although they seem to have a lot more people who are clerks instead of experts in hardware, they still have one or two of the old style hardware store experts working. And if you seek them out you get that warm, fuzzy feeling that you're being dealt with the way that you remember from years ago.

But to stumble upon one of the old-fashioned type hardware stores as I recently did and feel what it's like to have an expert go over all of the options (regardless of whether it meant a sale for their company) and give you honest, straightforward information was wonderful. This same person will usually suggest ways to make the project you are embarking upon easier to complete, more economical and more useful.

Quality of service important

Since we talk quite a bit about service to customers and since I've spent a lot of time pointing out places that don't provide decent service, I thought I would mention places that do provide the type of service that I believe is important to the future of this industry. Of all of the different businesses that have occasion to go into their customers homes, not many provide an employee for customer contact who knows more than a relatively singular thing, such as repair of the refrigerator, overhauling the furnace, etc. In our business, there are so many things that our customers want to know. There are so many things they want from us.

Take the issue of how you'll install the actual wires. Will they be visible or will they be hidden? How many outlets can I have? Do I hook my stereo FM receiver up as well? Did I pay for a cable-ready TV set for nothing? Who do I call when the service doesn't work? When can I call? How late are you open? Can I get an installation on Saturday? What kind of programs can I find on this cable system?

Oh, the naivete of the new subscriber! To think that one lone CSR would know the answers to all these questions. In all likelihood the person in the customer's home can answer a good many of them. They'll confidently reel off answers to such questions as, "where do I call if I have trouble?" and "what hours are you open?" They also confidently but, with some embarassment, give the answer that, in all likelihood you can't get an installation on Saturday, nor can you report trouble very easily. But as they get in their truck to drive away, they'll probably rationalize that it is, of course, company policy and since it's not under their control, they don't need to worry about it.

Please, do worry

I'd like to urge that everyone who has contact with a customer worry about those issues. If your company has a forum that allows you to state your opinion, everyone who goes into a customer's home should be willing to stand up and tell management what they think customers need and the kind of information they, themselves, need to provide answers.

Improving customer service in cable television requires a serious commitment from the top of the company, but it also requires a serious commitment from the service personnel in the company. These people are the ones who must find out what customers need and bring those impressions and comments to management. If enough installers, technicians or CSRs say that customers want the ability to call as late as six or seven o'clock at night and get a trouble dispatch, that will impress management. I've seen it happen. I hope to see it happen more and more in the future because I like my job in cable television.

If we don't take this challenge and work from the top with our service personnel, who have the customer contact, someone else will have this job. I'll be working away in my wood shop in the basement, not because I love it but because I have time on my hands. ■

By Wendell Bailey, Vice President Science and Technology, NCTA

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Reader Service Number 9

System G/T

The G/T of an earthstation is often used as a figure-of-merit for the performance of the receiving system. It is one measure of the earthstation's ability to detect very weak signals from the satellite in the presence of noise and it has a direct relationship, dB for dB, to the C/N of the received signal. The higher the system G/T, the higher will be the received C/N. In this column, we will investigate the various components of the satellite downlink, as well as some of the extraterrestrial sources of noise, that may contribute to the system's G/T.

What is G/T?

G/T, usually expressed in dB/K (dB per Kelvin), is the ratio of the receive system gain at some reference point in the system to the receive system noise temperature referred to that same reference point. In a typical system referenced at the LNB input, the "G" refers to the antenna gain, and the "T" refers primarily to the sum of the antenna noise temperature and the LNB noise temperature.

However, an in-depth calculation of G/T takes into account the noise properties of the downlink, and includes the contribution of the many earthstation components that might provide any gain, loss or noise to the received signal. It also includes any antenna noise contribution that may be caused by extraterrestrial (cosmic) or terrestrial sources of noise. Such noise contribution can be attributed to the reception of either broadband thermal noise, caused by the random motion of charge carriers in any medium, or perhaps to some other non-thermal galactic radio phenomenon, where some of the noise happens to span the microwave frequency region in which we are interested.

By Chris Bowick, Engineering Dept. Manager, Scientific-Atlanta

Noise sources

Distant galaxies, other planets, the moon, the sun, exploding stars and other extraterrestrial bodies or phenomena are all sources of noise to which the antenna system is susceptible. The sun is, of course, one of the most bothersome sources of extraterrestrial noise for an earthstation. Anyone who has ever witnessed a sun "outage" on their cable system will attest to that fact. In addition, depending upon the look-angle of the antenna, another source of noise might be from the surface of the Earth itself—both the land and the sea are potential contributors.

The contribution from the Earth will be greatest at low look angles from the antenna. This is due to, and is a function of, the nature of the dish antenna's directivity pattern and side-lobe structure. At low look-angles, the antenna's main lobe, as well as its side-lobes may be subject to illumination by the Earth's thermal noise. At higher look angles, the antenna cannot "see" the Earth as easily and it therefore contributes much less to the system's G/T.

In addition to the external noise sources that will inevitably be passed on by the antenna, there are several noise sources internal to the receive system that can contribute negatively to the overall system G/T. The most notable, and typically one of the largest contributors of noise, is the noise temperature of the low noise amplifier (LNA) or low noise block converter (LNB). This is somewhat ironic since it is the exceptionally low-noise properties of the LNB, when compared to other amplifiers, that allows the earthstation to perform at all. Nevertheless, its contribution is still significant.

But the LNB certainly isn't the only contributor. In fact, every component, active or passive, between (and including) the LNB feed and the satellite receiver will impact the receive system's noise temperature, and hence G/T, to some degree (pardon the pun). The only question is, "How much?"

Passive contributors

Passive devices such as OMTs, waveguides, coaxial cable and splitters all exhibit some amount of dissipative (resistive) loss and therefore contribute a small amount of thermal noise to the overall system noise and hence degrade G/T. The noise figure of the satellite receiver is also a potential negative contributor to G/T. The higher the receiver's noise figure, the worse will be the total system's G/T.

The amount of degradation to G/T contributed by the components following the LNB is primarily dependent upon the *gain* of the LNB. *The higher the gain of the LNB, the less impact other components further back in the receive system will have on overall G/T.* With LNB gains of 50 dB or greater, for example, system losses and noise contributions following the LNB are often considered to be negligible. This is why LNB gains of 50 dB or so are typical.

Improving system G/T

There are a multitude of ways to improve a system's G/T, including: increasing the gain of the antenna or LNB, decreasing the losses associated with waveguides, feeds, ortho-mode transducers (OMTs), coax or splitters, or decreasing the noise temperature of the LNB, for example. Several of these choices are impractical because of system constraints. But often it's an obvious cost/benefit tradeoff. It's usually a much easier and less costly improvement to G/T, for example, to replace an old 120-degree LNB having a gain of 45 dB, with a 70 degree/50 dB unit, rather than installing a new and larger antenna. Such a change could improve the G/T and C/N performance of your system (and S/N too, if above threshold) by a significant amount, depending upon the amount of noise contribution by other sources. ■

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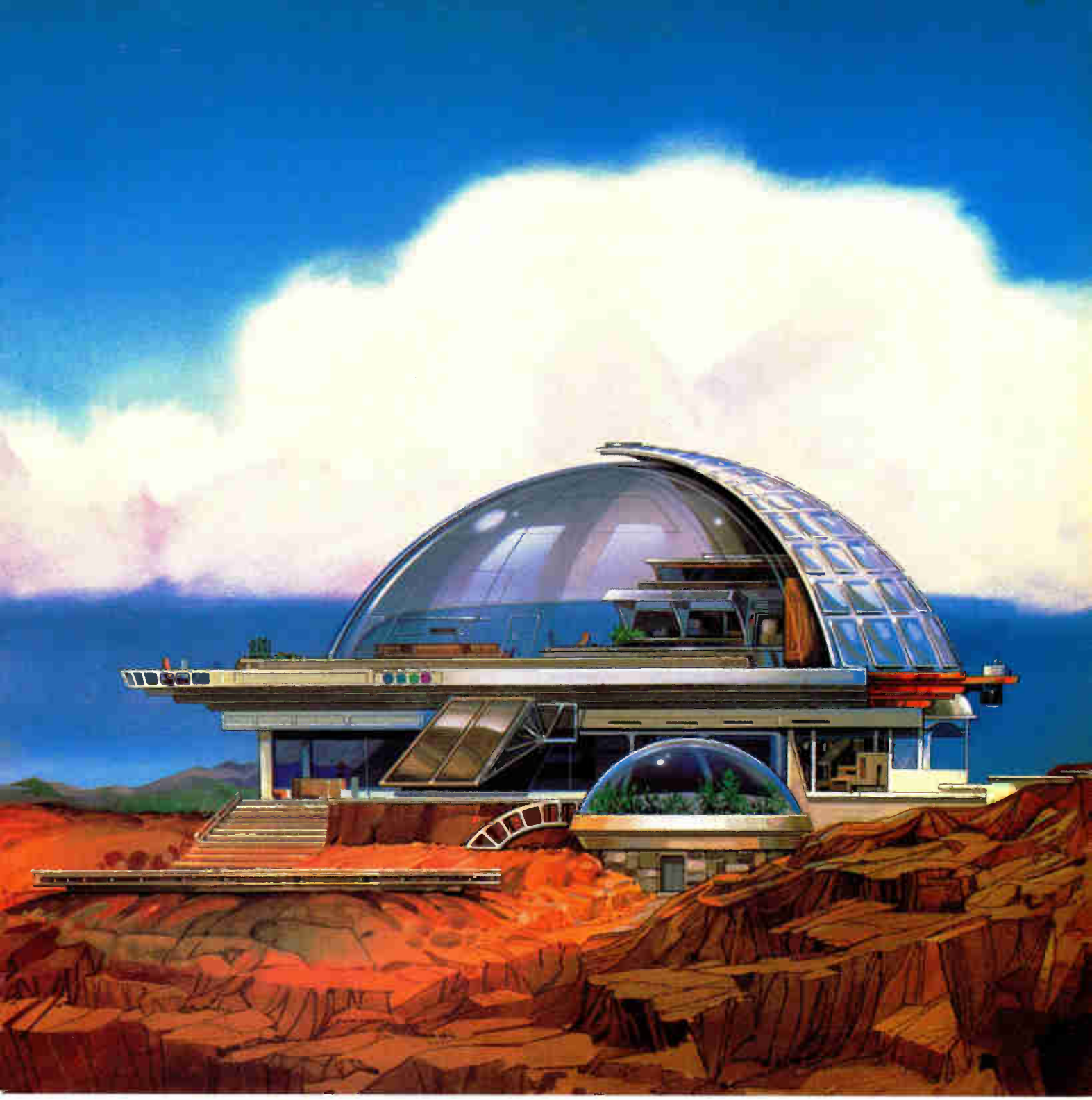

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Reader Service Number 10

"Mustn't carry" rules

In the waning days of Chairman Dennis Patrick's tenure, the FCC continues to pursue its marketplace philosophy in ways that erect barriers to the carriage of broadcast signals by cable systems. Three separate decisions in the last couple of months seem intended to negate the longstanding efforts by the FCC and Congress to preserve and balance the unique contributions of broadcasting and cable in a national communications framework.

First, the Commission refused to reconsider its decision reimposing syndicated exclusivity rules on cable operators. Those rules will require cable systems that carry distant broadcast stations to delete any programs carried by those stations for which a local broadcaster has acquired exclusive territoial rights. The FCC's rationale is that program producers and broadcast stations should have the right to contract for territorial exclusivity, and that such exclusivity can often enhance competition among broadcasters and among programmers.

That rationale is a valid one; the cable industry itself has maintained that exclusivity agreements between cable operators and programmers generally promote competition and program development. Nevertheless, the inevitable (and seemingly intended) result of the syndicated exclusivity rules adopted by the FCC will be to discourage cable operators from carrying distant broadcast stations.

In theory, some programming on a distant broadcast station will be deleted because of the local broadcaster's exclusive rights; some programming will be carried despite the local broadcaster's exclusive rights because the broadcaster will contract with the cable operator to allow carriage, and some programming, like news and public affairs programming, will be carried because no local broadcaster will have any right to such programming.

Cost prohibitive implementation

The technology for making such deletions and inserting alternative programming is costly, and finding such alternative programming may be difficult and expensive. Most significantly, cable subscribers are sure to be annoyed and confused when programs on distant signals that appear in the television listings don't show up at the appropriate time.

It's not just distant signals that seem to be the targets of the FCC's policy objectives. In May, the FCC voted to recommend that Congress repeal cable's compulsory license for the retransmission not only of distant signals but of local broadcast stations as well.

Under this license, cable operators are entitled to carry broadcast signals without obtaining permission from the copyright owner of each program on each station, provided that they meet certain terms and conditions, including the payment of a fee to the Copyright Office.

By eliminating transaction costs and preventing individual copyright owners from refusing to grant retransmission rights altogether (except where syndicated exclusivity rules apply), Congress sought to encourage cable systems to continue to provide broadcast stations along with the satellite services that were increasingly available.

The compulsory license has always stuck in the craw of those who believe that an unfettered marketplace unfailingly produces the most efficient results and best serves the public interest. For free marketeers, the benefits of eliminating exhorbitant transaction costs and of preventing sudden disruptions in established viewing patterns are outweighed by the marketplace distortions that could result from setting the fees too high or too low.

It's for this reason, rather than because of any inquiry into whether or not consumers would actually prefer the continued carriage of local and distant broadcast stations on cable, that the FCC voted to recommend elimination of the compulsory license—a step that would, like the syndicated exclusivity rules, simply discourage such continued carriage of broadcast stations.

The final straw

Finally, the FCC took a third step that reflects its hostility towards encouraging cable carriage of broadcast signals with "must carry" rules. The FCC preferred to rely not on must carry rules but on the use by cable subscribers of A/B switches for the over-the-air reception of broadcast signals.

Under the FCC's approach, the compromise must carry rules (between broadcasters and cable operators) were to be in effect for only five years. Cable operators would, however, be required to make A/B switches available for sale during those five years and to provide periodic statements to all subscribers informing them of the availability of such switches and of the fact that certain broadcast stations might not be available on the cable system.

When the court again struck down the rules in 1987 as still too restrictive under the First Amendment, it indicated that it was ruling only on the carriage requirements and not on the A/B switch and educational requirements. The FCC, however, stayed the effectiveness of those latter requirements, which neither broadcasters nor cable operators liked.

Meanwhile, the cable industry has again expressed a willingness to compromise with broadcasters on a reasonable must carry requirement, which they would propose to Congress. In May, however, the FCC suddenly lifted its stay, and the A/B switch and educational requirements are now to take effect on November 1.

The decision can only serve as a gratuitous reminder to Congress and the courts that the FCC believes that A/B switches are an effective alternative to must carry rules. And it is a further reminder, along with the syndex and compulsory license decisions, that the FCC wants no rules that will in any way encourage the carriage of broadcast stations on cable systems beyond what the marketplace demands. ■

By Michael Schooler, Deputy General Counsel, NCTA

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Reader Service Number 11

Outage reporting: How to react faster

Used to be, the cable folks would arrive in town, hang their shingle out and half the people in town would sign up. But things change. Cable's still in town, and the shingles have turned to neon, but the 50 percent who didn't sign up aren't jumping to cable based on promises of more channels. In today's industry, the other half is not only demanding quality programming but outstanding pictures on a reliable basis.

This facet of customer service has become such an issue that it could be called the achilles heel of CATV. Subscribers have not begun to rally and call their senators and congressmen because of repeats on premium channels, yet. Instead, issues such as poor picture quality, questionable reliability and rate increases have caused considerable stir in public arenas, which inevitably could lead to a political call to action.

Fortunately for cable's sake, many are becoming much more sensitive to customer service. More and more attention is being focused on improved service, and much of the excitement surrounding fiber optic technology is because of the increased reliability it promises. But while the talk is on improvement, action has only recently started.

The approach a cable system takes to reduce outages and response time is a matter of system policy or preference. Each system, hopefully, is focusing on better service in one way or another. For those who are still struggling to find the best method, there are ways to improve. Following are examples of several systems with unique, and successful, methods for improving customer relations. And for those who want a more automated approach, there are computer methods to help with outage reporting and tracking.

Finding the problem

Keith Burkley, vice president of engineering for ATC's Public Cable in Portland, Maine, considers their average 500 service calls a week as low compared to the same number of calls three years ago when the system had 16,000 less subscribers. More impressive is the 1.8 hour average response time to a system outage as compared to two plus hours in 1986.

"Quite frankly," says Burkley, "one of the first things we did (to improve response time) was to track and identify our problems." Another approach, and one unique to their equipment (RCA 150 and 151 series) is what is called a slug-to-trunk. This is basically redesigning how the AC flow is handled within the system.

Other areas that improved response time were training, and an intensive maintenance program that focused on checking a technician's case to ensure that any component that could possibly fail in the system had a backup and was functional. "I guess it was more procedural than technical," says Burkley, " but it was a big ticket item in terms of bringing down response time."

Tony Werner, vice president of engineering for Rogers Cablesystems in Eastern Canada, does a tremendous amount outage calculations and tracking for his 935,000 subscribers. In the Minnesota division, where Werner recently transfered from, the average response time for an outage—from the time the signal went out until it was restored—was 23 minutes, and 28 minutes repair time.

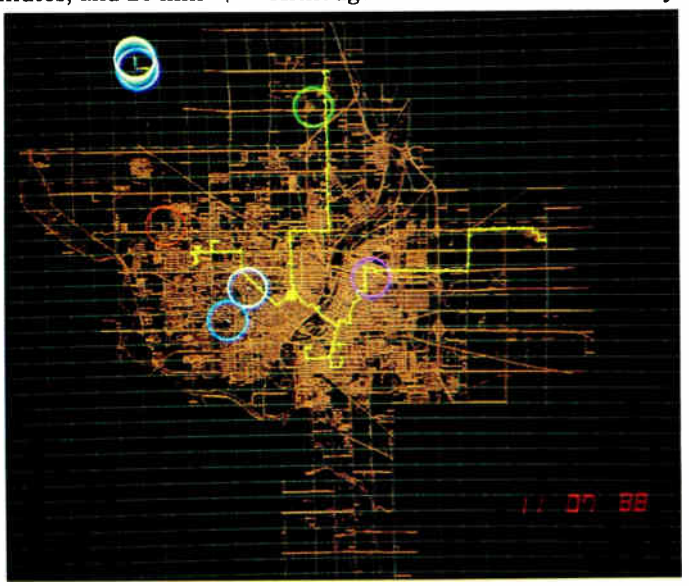
One method used by the Rogers systems to provide such a remarkable response time is to have all the techs working in zones. Each tech is also required to live in the franchise area which reduces response time after hours. Rogers also uses status monitoring quite extensively. Once a battery goes into battery backup, a digital timer is set for one hour. If the battery doesn't reset in one hour, a tech is dispatched with a generator. "In that situation," explained Werner, "you end up eliminating the outage in its entirety."

Because power failures account for 52 percent of the Roger's systems major outages (Burkley's system also reports 37 percent of their failures stem from power related incidents), status monitoring is also effective in alerting the system of an outage six to seven minutes before the first call comes in. "The other thing in maintaining quick repair time," says Werner, "is making sure you weigh the number of techs by the geographical area that you're covering and by your reliability statistics.

"The final point I want to make that helped reduce the number of outages significantly is running fail safe switching," says Werner. In the event that an amp loses power, it goes into a passive mode and anyone fed off that amp would not have good quality pictures, but typically the picture is restored. Going even further, in the Ontario system, Rogers personnel limit the number of amplifiers in a cascade to no more than two for each power supply.

Subs want more

Although all this accounts for a very



SecaGraphics on-line OVL shows realtime plant

reliable system for Rogers, it has an interesting side effect. Every year, Rogers conducts subscriber surveys to determine the level of customer satisfaction. The surveys showed that as the systems improved and provided more reliable, higher quality service to their customers, so did the customers expectations of system performance. "You could see the customer expectation advancing at a similar pace and in some areas even faster than the reliability of the system," reported Werner.

Though this may seem a frightening prospect, Bob Luff, vice president of science and engineering for Jones Intercable, sees a direct correlation between satisfied subscribers and revenue. "If you have a very high service ratio," says Luff, " you have a depressed multi-pay statistic. If you have a very low service call ratio—because of high quality pictures and a reliable system—people seem to feel better about cable and are more willing (to subscribe) to a higher pay to basic ratio and a higher multi-pay ratio."

Luff should know. During the course of one year, Jones Intercable has improved its service calls company-wide by 23 percent. Considering that Jones spent approximately 15 million dollars a year on service calls, that's an impressive statistic. "Half of that 15 million we caused ourselves due to lack of training, accountability in the field and professional workmanship focus," Luff said.

According to Luff, one of the first things required in order to acheive this reduction is to reduce the routine calls. Jones employs several methods in order to do that. One is to split the work day into two shifts. This reduces capital expentitures by allowing trucks to work double time and it also improves customer relations. Techs are now able to respond to subscribers who can't get off work, have babysitters or incur other job-related frustrations when trying to schedule appointments. Secondly, Jones employs the use of two way radios—extensively.

"It's amazing how many companies still don't employ two way radios to manage their installer force," commented Luff. "And again, not so much for emergencies or after hours but during the day."

Another area Luff focuses heavily on is the role of the dispatcher. "A lot of systems view a dispatcher as a level or so up from a general clerical secretary," he says. "That's a big mistake. When you think about it, the dispatcher is the person who is managing your work force minute by minute."

However, Jones' focus on the installer through its QIP (Qualified Installer Program) system has been the most instrumental part of the 23 percent reduction in calls. The essense of the program is to give installers a reference source and to provide feedback on individual performance. To Luff, it's not just better trained personnel, its money in the systems' pocket. "We're going to save about three and a half million dollars each year versus what we would have been spending if we didn't do anything at all," he concluded.

Enough for everyone

For systems wishing to see the same reduction in service calls, the same program is available through the efforts of Dana Eggert, president of Performance Plus. The concept of Performance Plus (which *is* the Jones QIP program) is based on the idea of a drivers license. An installer is given a manual and once they're comfortable with the contents, they are required to take a written and practical exam. Unlike a drivers license, the installer is then subjected to continuous feedback.

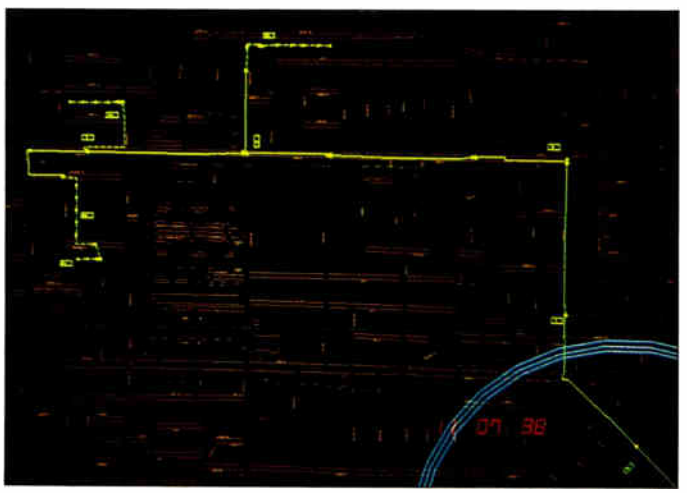
"People just naturally perform at a higher level if you tell them what to expect," says Eggert. "Secondly, you must provide them with the tools and the information. And finally, you give them feedback. That is the absolute critical part of Performance Plus," she continues. "It's the ongoing evaluation process that makes the program work and keeps the level of performance up."

One of the more impressive statistics Jones can boast from using the program is the total elimination of any call backs on new drops. And while this is indeed very significant, it doesn't entirely eliminate the problem—there is still the matter of past history. No matter how effective a system is in reducing service calls, the last 20 years will continue to haunt the operator.

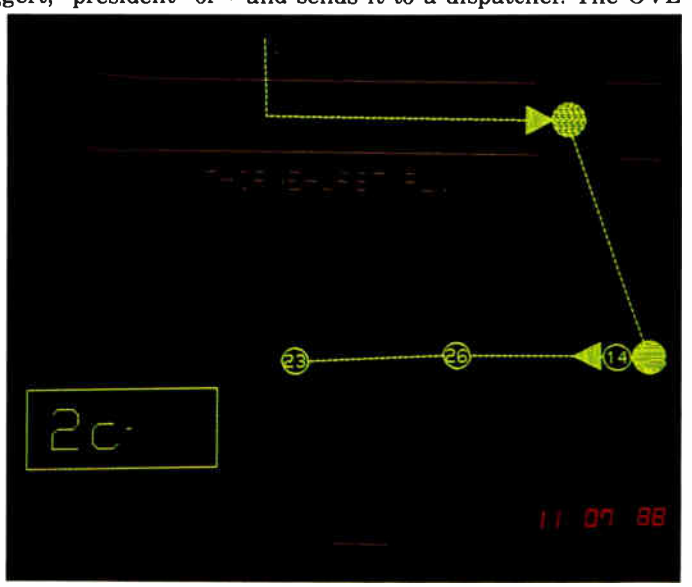
Let your computer do the work

A new and different type of response medium was recently announced at the NCTA show in Dallas by SecaGraphics. The Outage and Vehicle Location (OVL) system was developed by Terry Hulseberg, executive vice president for SecaGraphics, as a method to give a dispatcher an on-line tool in order to see realtime plant.

When a customer calls in with an outage, the CSR enters a service call and sends it to a dispatcher. The OVL



"Zooming" in allows for a closer look



Amps and power supplies are clearly marked

picks up the address and traces, on a map located on the screen in front of the dispatcher, all the plant from a subscriber's home to the headend. Anything the subscriber's cable goes through—taps, amplifiers, and so on—is noted on the screen. If the dispatcher gets three calls, and all three traces go through the same amp, a truck can be dispatched to fix, say, amp number two located at a certain address.

There are 1300 maps on the same screen, with the ability to zoom in on any map portion for a closer look. "One dispatcher can look over two to three times as much plant," says Hulseberg. Tracking service vehicles can be done two ways. One, the dispatcher actually sees where each truck is located and can zoom in for more information if necessary. Data such as driver name, location, time dispatched, expected completion time and type of call are all displayed.

The second method is through an interface with a real-time vehicle tracking system. "It depends on the degree a cable system wants to track," says Hulseberg. "Motorola has a module that plugs into a two way radio and it sends out vehicle real world coordinates within plus or minus 300 feet."

As described, the OVL is in a Phase I implementation. Phase II is an electronic dispatcher which allows for total automation. The computer is capable of taking the incoming call, tracing the plant and, based on X number of calls within so many minutes, will send a message to a service vehicle. The system can be interfaced to a billing system for address data, or it can be interfaced to one of the audio response units (ARU) available.

Outage reporting thru ARUs

Using ARUs in the cable industry for inbound and outbound applications is not new. However, what is new is outage reporting capabilities. CableData recently announced the addition of an interactive outage program for Dialogic's TeleClerk 386.

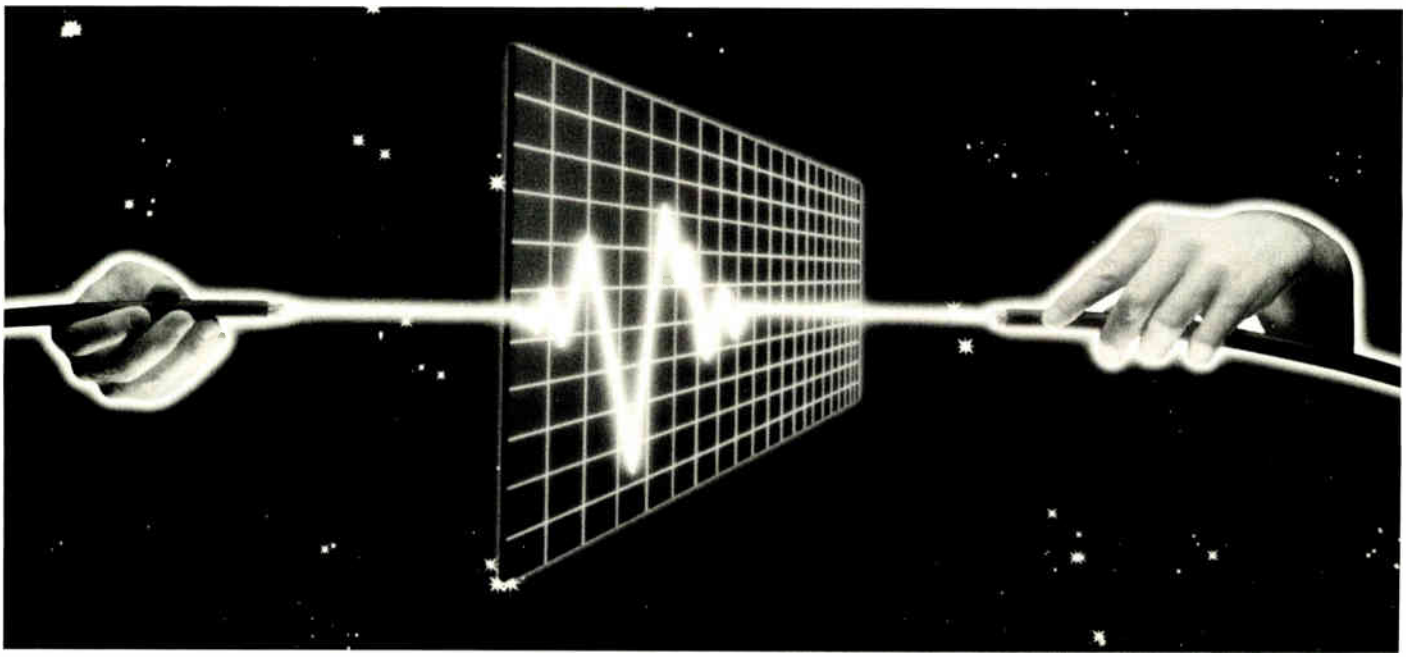
According to Ben Hughes, CableData's ARU product manager, the interactive outage application is capable of tracking an unlimited number of outages at the same time and detecting new ones. When a subscriber calls in to the ARU to report an outage, the data is transfered to CableData's data base where it is translated and interpreted. If the call threshold has been reached, which is parameterized by the operator, a message is given to the subscriber that an outage has been reported in their area and a tech has been dispatched. If the subscriber would like to be notified when service has been restored, the ARU will contact him once the outage is fixed.

"Essentially we just give them a message that says, 'yes, we recognize there is a problem' and we tell them we're working on it," says Hughes. Once the threshold has been reached, the ARU notifies system personnel of the problem through a computer printout at the dispatcher station or an outbound call to on-call personnel. Since amps and power supplies use incremental coding schemes, techs can look at related tables (sorted by the way an operator is tracking) and see at a glance where the problem is.

Another ARU vendor, Telecorp Systems, Inc., has also just released an outage reporting function for its System 6000. Using the same concepts as TeleClerk, except it is not interactive, the Telecorp system gives a list of zip codes where an outage has occured, asks the subscriber if they'd still like to report an outage, and notifies the caller when the outage is repaired.

Although both ARU outage applica-

DISCOVER THE CLEAR CONNECTION



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USWEST COMMUNICATIONS

Reader Service Number 13

tions were released within the last month, Telecorp's System 6000 and outage capability were tested extensively on May 5, 1989. Summit Cable of North Carolina, the system chosen as the beta test site for the outage function, was hit by a tornado that took out 35 miles of plant. Of the 70,800 subscribers, 40,000 lost their cable. For two days, Summit Cable was without power. But when the power was restored, "the phones started ringing," says Vicki Thaxton, director of business affairs for Summit. "The Telecorp system took, on an average, between 3,000 and 4,000 telephone calls a day for about six or seven days."

Summit Cable used the outage reporting capability to notify subscribers of the areas hardest hit. "Customers were just willing to know that the problems had already been reported and we would get back to them," says Thaxton.

Interface Technology, Inc., an ARU vendor with the Cable-IT system, is also capable of handling outage reporting. But according to Cindy Hardy, manager of marketing communications, the operator is excited about the capability but backs off once they hear how much they have to do. Each ARU system requires a data base or map grid of subscriber data.

Data versus radio communication

A different method of reporting and tracking system outages is a system that has just been introduced into the cable industry. Developed by East Ohio Gas, a subsidiary of Consolidated Natural Gas Company, is the C-ARDS (Computer-Aided Radio Dispatch System) mobile digital communication system. C-ARDS, a data communication system which interfaces to the billing system, is currently being installed in Cox Cable of Cleveland.

Each service vehicle is equipped with a mobile data terminal which the tech communicates through instead of a two way radio. The tech logs on in the morning and pulls up his job orders for the day. If he wants to notify a customer before arriving, he simply presses a few keys, and a computerized phone call is sent. After completing a job, the tech records the data into the computer using key codes. "Now dispatching has better control on what's been done, when it's done and where the tech is at all times," says Dennis Giancola, marketing specilist for Consolidated Gas.

The actual terminal is the size of a typewriter keyboard and is mounted on a pedestal in the truck. History is available to the tech, as well as any other information a system may have stored on their computer. Although there is no history of usage in a cable system, East Ohio Utility Company has been using the C-ARDS system for five years with superb results. Whereas customers were once told the problem would be fixed *tomorrow*, "they now provide a two hour window," says Giancola. "The increase in productivity has been phenomenal."

As the cable industry moves into the next decade, it's important that the image portrayed to potential subscribers is one of reliable, good service along with quality programming, and that may take extraordinary action on the part of the CATV. As SecaGraphics' Hulseberg says, "It's easy to get the first 50 percent, the next 40 will come hard." ■

—Kathy Berlin

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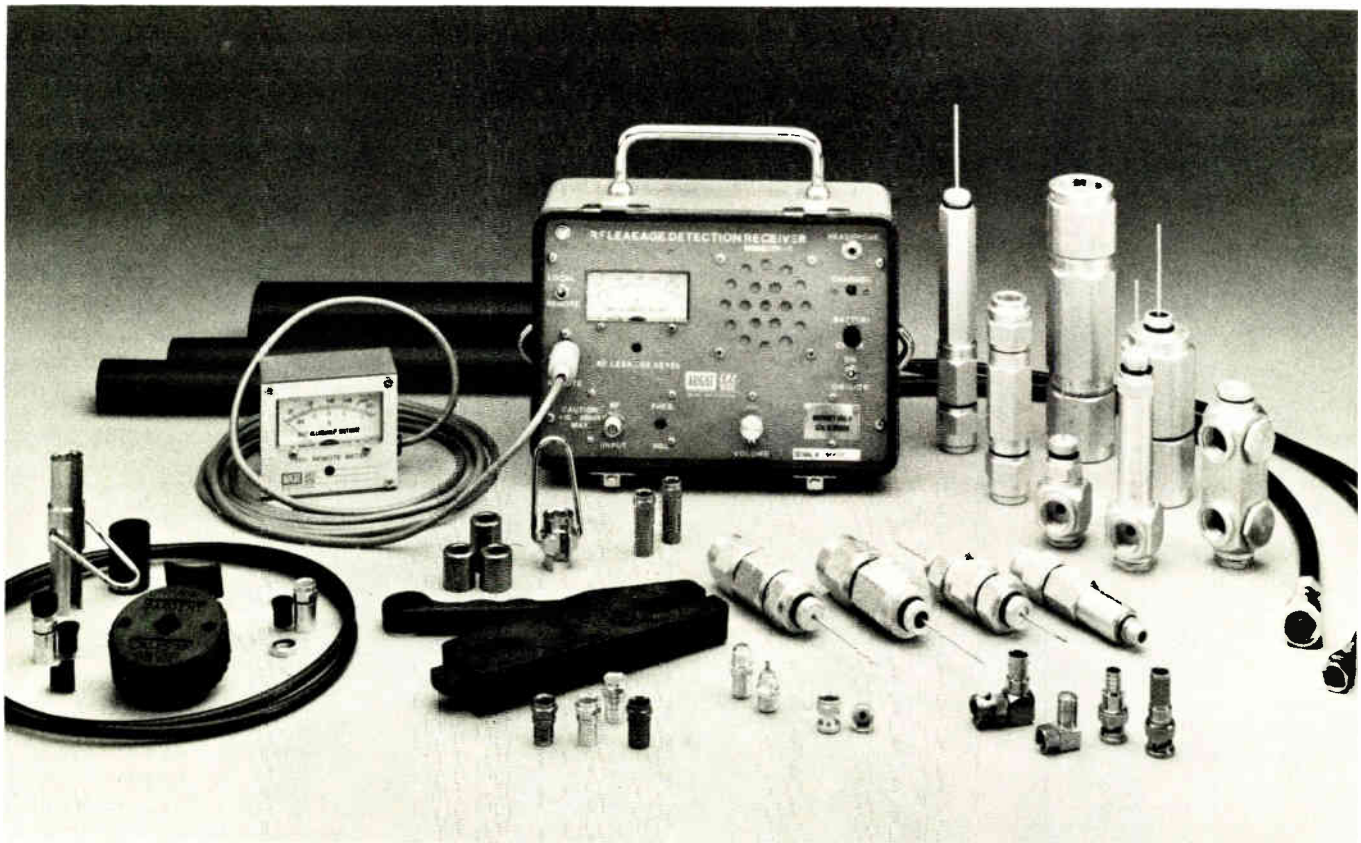

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We've only highlighted a few of our products, but at LRC, we have it all! Call us for details on these and other products at 607-739-3844 or 1-800-332-8428 or write Augat/LRC Electronics, P.O. Box 111, Horseheads, NY 14845.

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Reader Service Number 15

SCTE: Making a splash in Orlando

Bigger and better. Those are the buzzwords of marketers, but they also aptly sum up what attendees at the SCTE Engineering Conference and Cable-Tec Expo experienced in Orlando last month.

Emerging technologies were the focus of the Conference, while the Expo was packed with exhibitors showing off their latest hardware. The Society's board elected a new slate of officers, recognized the efforts of the UK's SCTE, and heaped awards on numerous individuals credited with the success of various SCTE programs and efforts.

Trower takes gavel

Jack Trower, president of Wehco Video and Region 8 director, succeeds Ron Hranac as president, while Richard Covell of Jerrold and Victor Gates of MetroVision were elected western and eastern vice presidents, respectively. Wendell Woody of Anixter was elected secretary and Pete Petrovich of Petrovich and Associates was elected treasurer.

As his last acts as Society president, Hranac announced that the industry has achieved 75-ohm traceability with the National Institute of Standards and Technology, essentially establishing a 75-ohm standard, and presented the prestigious President's Award to Byron Leech of the National Cable Television Institute for the organization's efforts toward personnel training.

Beeman: Member of the Year

The esteemed Member of the Year Award was presented by SCTE Executive Vice President Bill Riker and Mike Aloisi, last year's winner of the award, to Paul Beeman of Viacom Networks in recognition of Beeman's contribution to the organization. Special Recognition Awards were presented to Tom Hall, secretary of the SCTE in the United Kingdom and Glenn Jones for distributing the *Jones Dictionary of Cable TV Terminology* to all Society members for free.

Other highlights of the four-day event included Wavetek's donation of $5,000 to the SCTE's new building fund, which was established to retire the debt on the National Headquarters, which recently was doubled in size. Wavetek's donation was the initial contribution to the fund, which needs about $145,000 to retire the mortgage.

Jack Trower accepts the gavel—the symbol of the SCTE Presidency—from Ron Hranac at the awards luncheon during the annual Engineering Conference. Photo by Rob Stuehrk.

New products

New product introductions were also plentiful, making this one of the most news-oriented Expos yet. Those introductions included the following:

Anixter Cable TV introduced the new Anixter Rotary Splice (ARS) which features a polishing tool that introduces a 10-degree angle to the ends of the fiber optic cable being spliced to reduce microreflections. The performance characteristics are said to be permanently stable over a wide range of ambient temperature and humidity variations. The ARS is applicable for CATV applications that require reflection levels of -58 dB and below.

Anixter also introduced the new Sync Link FM fiber optic system manufactured by **Synchronous Communications**. The Sync Link system transmits scrambled channels with better than 60 dB S/N. The system uses only one encoder per scrambled channel and works with baseband or sync suppression scrambling schemes. The encoded signals are converted to TV IF format for distribution at the hub site. Anixter Cable TV, (312) 677-2600.

More fiber news

While we're on the subject of fiber optics, **Catel Telecommunications** announced a new, better performing version of its TransHub III AM system. The strand-mounted hub uses "high performance" lasers and detectors to achieve better specs at greater loss budgets, says Dr. James Hood, Catel president.

According to Hood, TransHub IIIHP will deliver 18 channels over a single fiber with the following specs: 55 dB S/N, -70 dBc second order and -65 dBc triple beat with a 7.5 dB optical path loss. When the path loss is increased to 11 dB, Hood says the specs become 53 dB S/N and the distortion specs remain the same.

Hood says he believes this allows cable operators to design a system that has more splices and fewer lasers,

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making the system cheaper to buy. Because it allows operators to expand their systems into new growth areas, Hood believes Catel can now target the expansion market in CATV, not just the rebuild market. Catel, (415) 659-8988.

New from **Channelmatic** is the CCU-202A adcart Channel Control Unit designed for the random-pod-sequential user who wants lower priced sophistication. The unit has the full features present in the CCU-402A and will control one or two VCRs on one channel or one VCR on each of two channels simultaneously.

Other features include stereo audio, all-channel CRT status display, CMOS-based design, computer adjustable audio levels, full error reporting and direct spot-to-spot cueing, among others. The unit is available and priced at $2,625 per channel. Channelmatic, (619) 445-2691.

New video voltmeter

FM Systems introduced the VVM video modulation meter to measure depth of modulation. The digital meter is a hand-held and battery operated meter that is connected to the 45.75 MHz IF loop on the TV modulator though a 20 dB directional tap. According to Don McClatchie, manager of sales for FM Systems, the unit measures peak video signal and is capable of accuracy to 1/10 of one percent. The meter automatically compensates for variations in power output. FM Systems, (714) 979-3355.

New from **Hewlett Packard** are the HP 8590B Option 003, HP 8591A, HP 8592B Option 003 and the HP 8593A spectrum analyzers. All four analyzers add program memory and up to 50 trace storages, says Jim Boyer with the signal analysis division of Hewlett Packard. An additional feature of the new analyzers include frequency accuracy over the 8590 series. The 8591 is capable of ±1.9 kHz at 1 GHz accuracy. The HP 85711A CATV measurement card used with the spectrum analyzers is the size of a credit card and has a 32K memory. Hewlett Packard, (707) 794-2652.

New receiver

ISS Engineering introduced the addition of the GL5020 satellite receiver. The C- or Ku-band receiver provides, as a standard feature, compliance with RS-250B long-haul specifications. For cable applications, the VideoCipher can slide in the front of the panel, allowing for easy removal. The front panel access, which includes "address" data for the VideoCipher, also allows for maintenance of the unit. Features of the GL5020 include switchable bandwidths, de-emphasis and is compatible with all popular encryption formats. ISS Engineering Inc., (205) 853-6919.

Lectro Products announced additions to its product line in both ferroresonant and standby power supplies. Now claimed to be "the widest choice of power supplies made in the USA," according to Mike Kearns, national sales manager for Lectro, the ferroresonants are available in 2-, 4-, 6-, 9-, 12-, 15- and 18-amp configurations. The standby supplies are available in 4-, 6-, 9-, 12- and 15-amp systems.

Also announced was a complete range of U.L. listed meter bases for both standby and ferroresonant applications.

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Reader Service Number 18

These meter bases are approved for installation throughout Southern California and elsewhere. Lectro Products Inc. (404) 543-1904.

Midwest CATV, a division of Midwest Corp., announced it now is the exclusive distributor of the Milenium 2000 product line, manufactured by Antronix. The Milenium line includes multi-taps, house drop passives and line passives. Additional features of the multi-tap include interchangeable tap plates between 2-, 4- or 8-output or any tap values, brass ports and a 1 GHz cavity housing made from aluminum alloy.

Also announced by Midwest CATV is the expansion of its Sync System, a "warehouse on wheels" approach to stocking and delivery of products to cable systems. The expansion includes two new trucks out of an Ocala, Fla., facility. The trucks will service Georgia and Alabama along with the Florida route. Previously, the Sync system served only the Midwest. Midwest CATV, (304) 343-8874.

Solving syndex

Introduced as the "syndex solution," **Monroe Electronics** announced the new Series 3000 generation of switching equipment. According to Brian Ives, executive vice president for Monroe, the program timer series, switcher panel series, audio/video module and cue tone receiver series allows for a "flexible switching opportunity." The program timer series 3000 is capable of 999 events, 16 open collector outputs and an RS232 port for up/down loading program data.

The cue tone receiver series features four receiver inputs, telephone override of cue tones and on-site cute tone programming by rotary switches. Monroe is now accepting orders on the Series 3000. All products will be available in the fall of 1989. Monroe Electronics Inc., (716) 765-2254.

Northeast Filter Co. Inc. announced a new square trap which Northeast has dubbed the "super saver trap." According to Tim Holdsworth, president of Northeast Filter, the trap helps save adjacent channels and is twice as sharp as a normal trap. The square trap will be in production at the end of 1989.

Northeast also announced year end production of the LAF filter for leakage analysis. The filter features 30 dB attentuation on a leakage analysis carrier to diagnose and isolate system leaks, reports Holdsworth. Northeast Filter Co. Inc., (800) 888-7277.

Oak is Zenith compatible

Oak Communications showed off its new, smaller Sigma 2000 converter and showed system compatibility with Zenith Z-Tac equipment. According to Tony Wechselberger, vice president of domestic operations, both products will be in production in the four th quarter of 1989. Oak, (619) 451-1500.

Paul Beeman of Viacom Networks speaks after being named Member of the Year. Photo by Rob Stuehrk.

Qintar Inc. announced the packaging of a VCR kit containing the Tab-2 A/B "top switch." The QAB-K2 VCR kit contains the Tab-2 switch with 95 dB isolation, a DS-75-2 CATV splitter with over 100 dB RFI shielding, a TR-1000 matching tranformer and three 36-inch RG59 60 percent braid jumper cables.

Qintar also introduced a new agile modulator with adjacent channel compatibility. The model AVM 7060 combines agility and stability and offers output channel selection of VHF channels 2 through 13, midband A through I, superband J though W, A-1 through A-6 and hyberband AA through WW. The AVM 7060 also offers a front panel FCC offset switch for required 12.5 kHz or 25 kHz and a rear panel switch for standard, HRC and IRC offsets. The AVM 7060 is capable of +60 dBmV output. Qintar Inc. (800) 252-7889.

The **R.L. Drake Company** introduced a new audio/video modulator, the VM2310. The modulator is aimed at small to medium sized cable systems and SMATV systems. The VM2310 has a lower noise floor and automatic off-sets on mid-band, according to Philip Hawkins, commercial products manager for Drake. The frequency-agile, vestigial sideband unit operates with an output level of +45 dBmV and access to 23 channels from 54 MHz to 216 MHz.

Also announced by Drake was the model VM200, VHF-only modulator. Designed for the low real-end market, the VM200 provides provides channels 2 through 13 and sells for approximately $200. The VM200 is a double sideband modulator and is also frequency-agile.

A final announcement from Drake was the ESR2235 earth station receiver with a high level of IF signal processing and a B-MAC video output. Features of the ESR2235 include block down conversion with Drake's BDC-24 weather-proof block down converter or LNB; dual signal inputs with automatic or manual polarity changeover; 950 MHz to 1450 MHz IF loop-through output and a SAW filter for adjacent channels and interference rejection. R.L. Drake Company, (513) 866-2421.

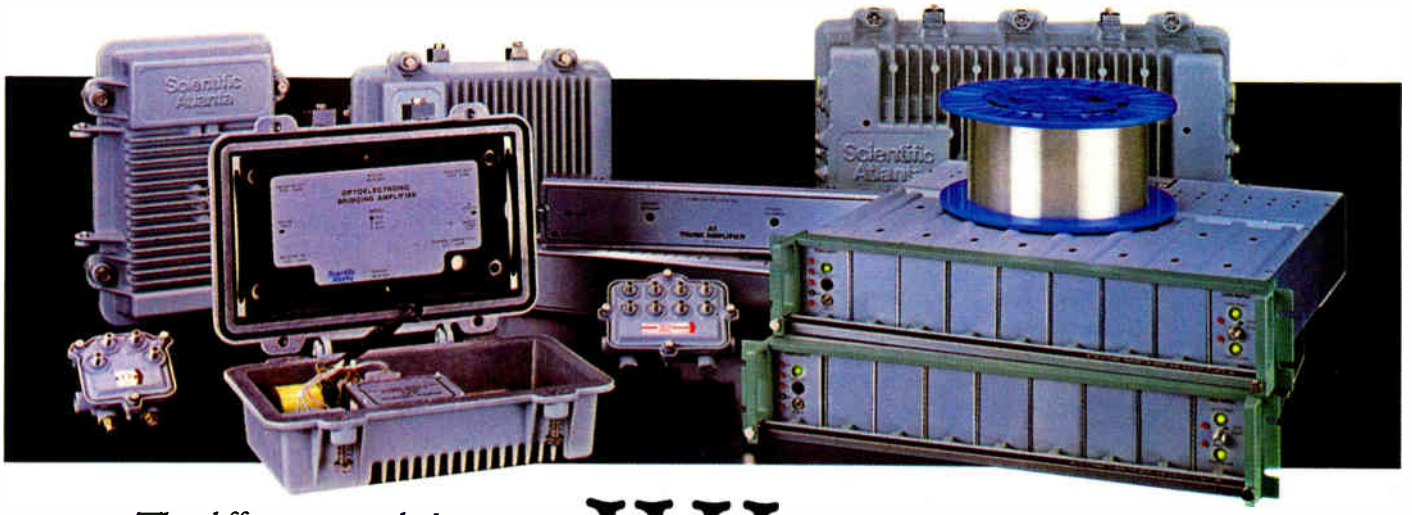
Signal Vision announced the appointment of Jerry Conn & Associates as the exclusive distributor for its directional tap product line. The addition of Jerry Conn & Associates with John Weeks Enterprises will allow for nationwide coverage. Signal Vision Inc., (714) 586-3196.

Need a flyover done?

New to the cable industry is **Skytek Inc.**, an aeronautical RF leakage detection company. The Kansas-based company locates and identifies RF leaks for the purpose of FCC regulation compliance ("flyovers"). Skytek also shows systems where the leak is by use of a microcomputer mapping software program that identifies leaks as they relate to streets, highways or other key features which can be printed on a common dot-matrix printer. Skytek Inc., (913) 764-3400.

Standard Communications Inc. announced the adoption of a Lifetime Loaner Program to minimize downtime resulting from equipment failure. "We felt we wanted to provide service in emergency situations," said Mason Truluck, director of the Satcom division. The program guarantees overnight shipment of a compatible unit within 24 hours of equipment failure. The customer has full use of the loaner unit, at no charge, until Standard completes repair of the defective unit. The program includes older models

Do You Know The Difference Between Telephone And CATV Fiber?



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Reader Service Number 19

Coming to grips with the future

The cable industry's engineering community sent a message to the rest of cable management in Orlando last month that may or may not square with what everyone wants to hear, but it's what ever more people are thinking.

The topics of the Engineering Conference at the opening of Cable-Tec Expo '89, staged by the Society of Cable Television Engineers, are enough to tell the story: "High Definition Television;" "Digital Video: A Future Alternative;" "Cable vs. the Telcos;" and "Fiber Optic Technology." Together, the panels portrayed an industry confronting a future driven by technological developments that cannot be ignored, no matter how unpleasant the implications might be.

Lambasting the telcos

"Competition for cable TV is on the horizon," said Steve Wilkerson, president of the Florida Cable Television Association, who spoke fervently against what he described as a telco mindset that would look favorably on renaming the country "the United Divisions of Bell." And, indeed, much of what was said from the podium and from the big exhibit floor at the Orlando Convention Center seemed to be based on the assumption that the cable industry must exploit its technological options with a clear appreciation that it does not hold an exclusive franchise on the future.

Pro-digital voices

The engineering conference, with one session devoted to a vendor's pitch for all-digital, fiber-to-the-home technology and another pitting two pro-digital, all-fiber network voices against a non-tech defender of cable's turf, offered a vivid contrast to the point of view fostered at the recent National Cable Television Association Convention, where the starting point in the now-familiar littany of telco-bashing was that all-digital, fiber-to-the-home is a pipe dream. Asked why his group gave so much time to the airing of a different point of view, J. Richard Kirn, chairman of the conference committee and president of Wire Tele-View Corp., a small MSO, commented, "Digital technology, along with fiber, is moving forward very rapidly, and we can't pretend it's not. Now is the time for the industry to be looking at these things and figuring out what has to be done."

The Engineering Conference offered a vivid contrast to the point of view fostered at the recent NCTA convention where the starting point in the now-familiar littany of telco-bashing was that all-digital, fiber-to-the-home is a pipe dream.

Claiming that the telcos want "to take over the video market," FCTA President Wilkerson warned that the cable industry faces "one of the most formidable political powers in the country." He noted that Florida's legislature had passed a bill directing the state public service commission to prepare a report on telecommunications technology and communications law in the 21st century that would serve as "a comprehensive overview for a new regulatory framework."

Telcos' four goals

Wilkerson predicted that the local exchange carriers, "with Southern Bell at the forefront," would lobby on the local and national fronts with four large goals in mind: to promote the local carrier as the provider of one wire to all customers; to accelerate the depreciation rate of copper and switches to enable rapid deployment of digital switching technology and fiber optics to the home; to secure adoption of the Bell Cost Allocation Manual as the standard for governing prevention of cross subsidization between regulated and non-regulated businesses, and to do away with the rate of return method of controlling prices in order to "avoid heavy regulatory scrutiny" of the telephone business.

The telco position on these matters was presented by Mark Balmes, operations manager for BellSouth Services, who characterized the push for fiber deployment more as a matter of business survival than as an Information Age boon for the nation. Citing a residential revenue stream averaging $10 per home per month in the Orlando area, Balmes said his company, as a heavily regulated business with responsibilities to shareholders, had to generate enough revenue from services to businesses and from other enterprises to both subsidize the residential phone rate and show a profit. With competitive inroads from other suppliers of business services threatening profitability, Balmes said deployment of the all-fiber broadband integrated services digital network "is the key to survival of the operating company."

Making fiber work

Balmes said that his firm had put out a request for quotations to the vendor community on the premise that the parity cost of fiber versus copper on a per-household basis is $1,600 and that other Bell companies would help create sufficient demand to drive costs down. Out of 20 vendors contacted,

By Fred Dawson, Special Correspondent

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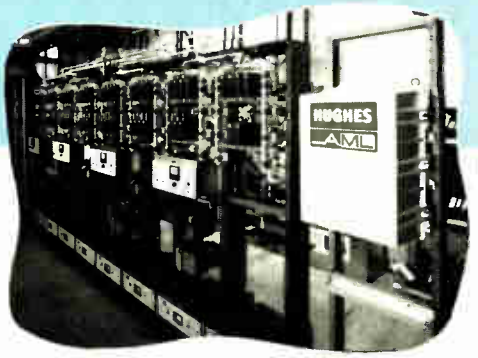

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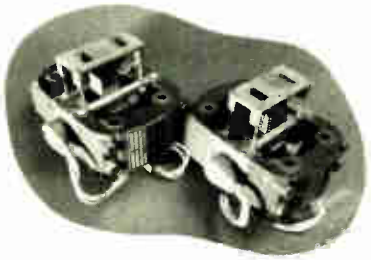

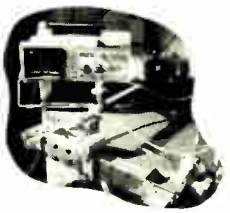

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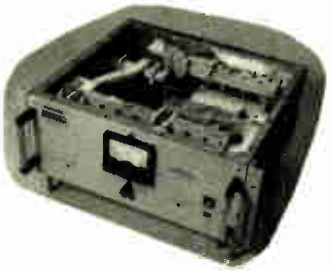

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Balmes said, nine had responded with offers of a "viable product in a 1989 timeframe."

Noting the rapid advance of technology, which will witness a jump in transmission speeds between central offices over fiber from 1.2 gigabits/second this year to 2.4 Gbits/sec next year, Balmes said the likelihood is that the cost for deploying broadband ISDN on a nationwide basis will be about $2,000 per line, or about $400 above the parity level between fiber and copper for narrowband service provision. Over an installed base of 100 million lines, he said, the cost would come to $200 billion. Such a cost could be recouped within 10 years, he added, at a per-home rate of only $30 per month.

Balmes said BellSouth presently views cable TV as a business unto itself which would benefit greatly from sharing the network facility with the telco. "We're trying to establish relationships with cable TV companies," he said, "not to manage the programming ourselves." But he noted that the telco distinguished cable TV from other video services, such as videophone or video on demand, which the telco would offer itself or others would offer through use of the transport facility on an open access basis.

Here comes digital

Digital transport over fiber is not a matter of gambling on future potential, Balmes stressed, noting that the telco has reached the 65 percent level in deployment of fiber as a replacement to copper in interoffice trunklines. "The introduction of these technologies hasn't been in a vacuum," he commented. "We wouldn't have realized success in the pursuit of regulatory approval if the economies of scale hadn't been successfully presented at every step along the way."

Underscoring Balmes' assertion of the feasibility of the all-digital, all-fiber approach to telephone and television service distribution was a presentation on digital-to-the-home technology by Steffen Rasmussen, president of ABL Engineering, a manufacturer of switches, codecs (analog/digital coder/encoders) and other digital telecommunications gear. Rasmussen described an approach to fiber delivery of voice, data and video signals that involves combining the CATV services with telco services at the telco central office and switched selection of video channels and voice/data circuits at a remote terminal.

Rasmussen said new compression techniques had brought the digital rate for full-motion, medium-haul quality video down to 34 Mbits/sec, which would allow transport of 48 video channels from the central office to the remote switch at a rate of 1,640 Mbits/sec. Each user line would carry up to three videos and 16 voice/data channels from the subscriber output board at the switch, operating at 140 Mbits/sec. All signals would go into a box at the home about the size of a circuit breaker unit, Rasmussen said.

The parts are here today

He emphasized that none of this is future technology and that prices could be well within telco per-household cost targets if demand is strong enough. "We're already making all of these components for use in different applications, such as video conferencing and distributed data processing," he told *CED* magazine. "It would not be a

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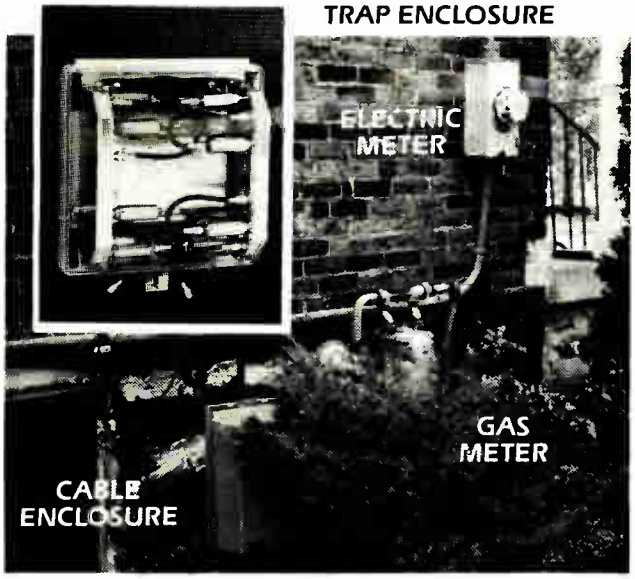

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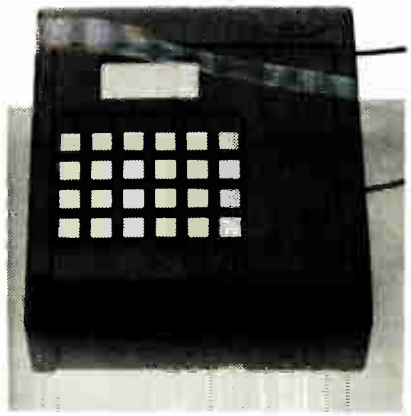

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(E) Picture and sound distortions are minimized.
(F) Switch boxes or complicated wirings are not required.

A trapped system is very friendly since all subscribed to channels are present at each TV set simultaneously in an unscrambled mode. Only undesired channels are removed. When addressability and Impulse pay-per-view are added, as with Eagle's Addressable Trap System, consumer friendliness, versatility, and economy for today's system operator are the result. The control box in which the traps are located is outside the home similar to electric, gas or water meters, eliminating the need for customer change of service or repair scheduling.

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- 4 or 8 tiers of negative, positive or multichannel addressable filters; 256 combinations selectable.
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- Controls signal delivery to multiple TV sets from one trap switch enclosure.
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2/1/89

Reader Service Number 24

problem to put the pieces together for a network application like the one described here."

The point of these presentations seemed not so much to be that cable television should adopt telco approaches to technology but that cable should act resolutely in pursuit of its own advances. In a concluding session on fiber optics, Jim Chiddix, senior vice president of engineering for ATC, took strong exception to the assertions of one panelist that the CATV industry was barking up the wrong tree in pursuing analog fiber technology. "The proof that AM fiber technology works is all over the exhibit floor here," he stated.

Indeed, the progress in AM fiber link performance has surprised everyone, including the vendors themselves. The latest field reports point to performance levels that far exceed the levels of AM systems on the market earlier this year. For example, Anixter Cable TV President John Egan reported that the first link going into the Jones Intercable system upgrade in Augusta, Ga., the first CATV installation to deploy fiber trunklines on a system-wide basis, was operating at a carrier-to-noise output of greater than 56 dB, with composite triple beat at -72 dB. The line carries a channel load of 36 channels.

Along with performance improvements, prices are beginning to come down. John Simons, vice president of marketing for Times Fiber, said his firm's AM links, which are about to be put into a field test by CableVision Systems, have dropped significantly in cost since last fall, with the lasers down by 25 percent and receivers down by 17 percent. The cost of a link from T-F's sister firm, American Lightwave Systems, is now about $25,000, Simons said.

Improvements from receivers

Simons added that, for now, the main improvements to be expected in AM links will be at the receiver end, until new analog lasers go into production, which could be as soon as next Christmas. He said a new generation of receivers promises to provide a performance gain of 1 dB or 2 dB in C/N.

Expectations are high that major improvements in AM fiber performance are near at hand, thanks to development of lasers structured specifically for the CATV market. Fujitsu, AT&T, Mitsubishi and Ortel are among the manufacturers racing to bring a new generation of high-performance analog lasers to market. As a result, it could well be, some sources say, that the lightwave CATV product lines offered at the Western Show this year will promise vastly improved performances over the present lines.

Given the rapid advances in digital technology, the good news in all of this for the CATV industry is the modularity of fiber optics. As many convention participants pointed out, by taking advantage of the present cost effectiveness of AM and FM lightwave capabilities now, the cable industry is getting a headstart on telcos and will be able to shift to digital distribution over already installed fiber links/

In a conversation with *CED*, Walt Huff, a former marketing and engineering executive for US West who is now working with TCI, noted that so long as the cable industry has a state-of-the-art plant in operation, it will be very difficult for telcos to compete. "The economics for overbuilding cable TV just aren't there, no matter what legal changes might be made, and the telcos know it," he said. ■

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Rogers fiber architecture

Cable system network architectures in urban centers must undergo substantial changes in topology if they are to adequately meet the transmission challenges of the next decade.

The demand for additional channel capacity will persist. The demand for substantially higher quality television signals will escalate as the population moves toward larger screen TV receivers with high resolution capabilities. The introduction of advanced television formats means anything but near perfect transmission will be considered unacceptable.

Accommodating additional channel loading severely stresses existing coaxial technologies, especially in larger networks. Simultaneously achieving substantially superior transmission quality while accommodating the extra channel loading becomes an engineering challenge not seen by the industry since the early innovative days of trying to operate at VHF frequencies.

Customers are not only demanding quality, they want reliability. Their tolerance for interrupted service rapidly diminishes as monthly rates increase. Customers taking non-programming services such as data transmission for businesses or private network voice communications are totally intolerant of interrupted service. Yet the incremental revenues from these sources are essential for the industry's growth.

Compounding the foregoing challenge are rapidly increasing operating costs, and growing reluctance amongst field personnel to working outside normal business hours. Whatever technology is devised to meet the performance and reliability challenges of the 1990s must also address this operating issue through the provision of diagnostic aids and automation of transmission and equipment redundancy.

Rarely can a cable television engineer start with a clean sheet in developing an optimum architecture to meet the foregoing challenges. They must take an existing network and devise an evolutionary approach in upgrading that network while utilizing as much as they can of the existing infrastructure to conserve capital while providing minimum interruption to the on-going cable services.

Rogers Cablesystems Inc. is confronted with this challenge in all its major Canadian centers. Its existing plant has to be rapidly upgraded for at least 58 channel capacity by late 1990 and 77 channels by late 1993. Simultaneously, it must improve its transmission quality with a target of 49 dB carrier-to-noise at the subscribers outlet together with non-linear distortion performances no less than that presently provided at the lower channel loadings.

In most centers the coaxial cable, supporting strand, and other hardware are generally quite sound so logically should be utilized as much as possible. Furthermore, recognizing the difficulties in obtaining access to utility structures, especially in these major urban centers, it is also logical to implement the new architecture utilizing existing cable routes. Bridgers, feeder cables and interconnecting nodes should hence remain as presently located, as should equipment vaults, pedestals, ducts, etc.

An initial architecture was derived based on current coaxial technology, high performance feedforward amplifiers, multiple AML hubbing, back-up supertrunks and other conventional approaches. The performance requirements could be met, however the complexity of the hubbing network, the very high demand on AC power, very large number of active components and limited ability to evolve past the 77 channel capability made the exercise cost ineffective and operationally unattractive. Concurrent with this coaxial planning activity were announcements of the breakthrough by ATC in achieving multiple channel AM transmission through its backbone fiber network.

Encouraged by this, Rogers engineers revisited their upgrade architecture applying fiber optic technology wherever it made sense. Rogers was already familiar with using fiber optics for a number of specialized programming feeds as well as some substantial early work on multiple channel digitized video transmission over an 8-kilometer trial link. The architecture adopted by Rogers is explained in the following paragraphs.

Hub deployment

The deployment of fiber to connect many newly created hubs allows evolution of the CATV network to meet the future needs of higher channel capacity and signal quality referred to earlier. The establishment of additional hubs is needed to reduce the length of amplifier cascades, the key to achieving the above goals.

The upgrading of plant to 550 MHz and improvement of CNR to 49 dB at the wallplate requires trunk cascades be restricted to 10 feedforward amplifiers. The establishment of additional hubs allows existing trunk and feeder cable to be left as is. Existing trunk amplifiers are upgraded but no respacing is required. Approximately half of the amplifiers need to be turned around since long cascades will be broken mid-span. The Rogers system in Toronto, Canada will require 60 hubs to service 600,000 subscribers with 550 MHz capacity.

The 10,000 home areas served by each hub will be miniature cable systems. Reliability will be much higher and maintenance will be easier due to the short cascades. In urban regions, these areas are approximately 10 square kilometers in size which is similar to fourth level cellular telephone cells. In Rogers' case, it was a natural conclusion to combine facilities for CATV hubs and cellular telephones since Rogers owns the Canadian cellular telephone company, Cantel, which competes with the telephone company cellular operator. A similar synergy may exist for many CATV operators in the United States.

The primary benefit from cooperation with a cellular operator is the sharing of installation costs for the fiber cable to interconnect cellular cells and CATV hubs. Common facilities for both entities, which may produce additional savings through shared powering, environment control and real estate, is not essential to benefit from a shared fiber network. In most cases the new telco cellular operator will welcome dealing with a non-telco partner for intercell communications.

In a 600,000 subscriber system like Toronto, the hubs must in turn be

By George Hart and Nick Hamilton-Piercy, Rogers Engineering

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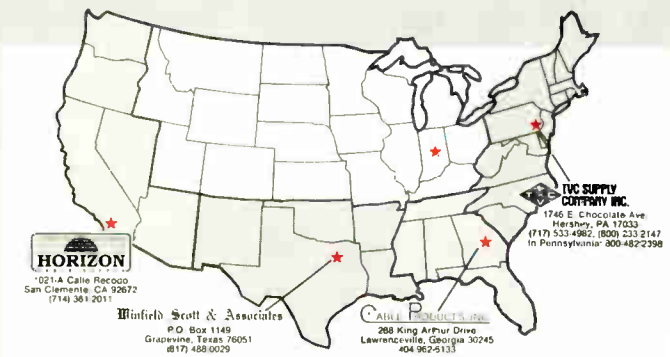

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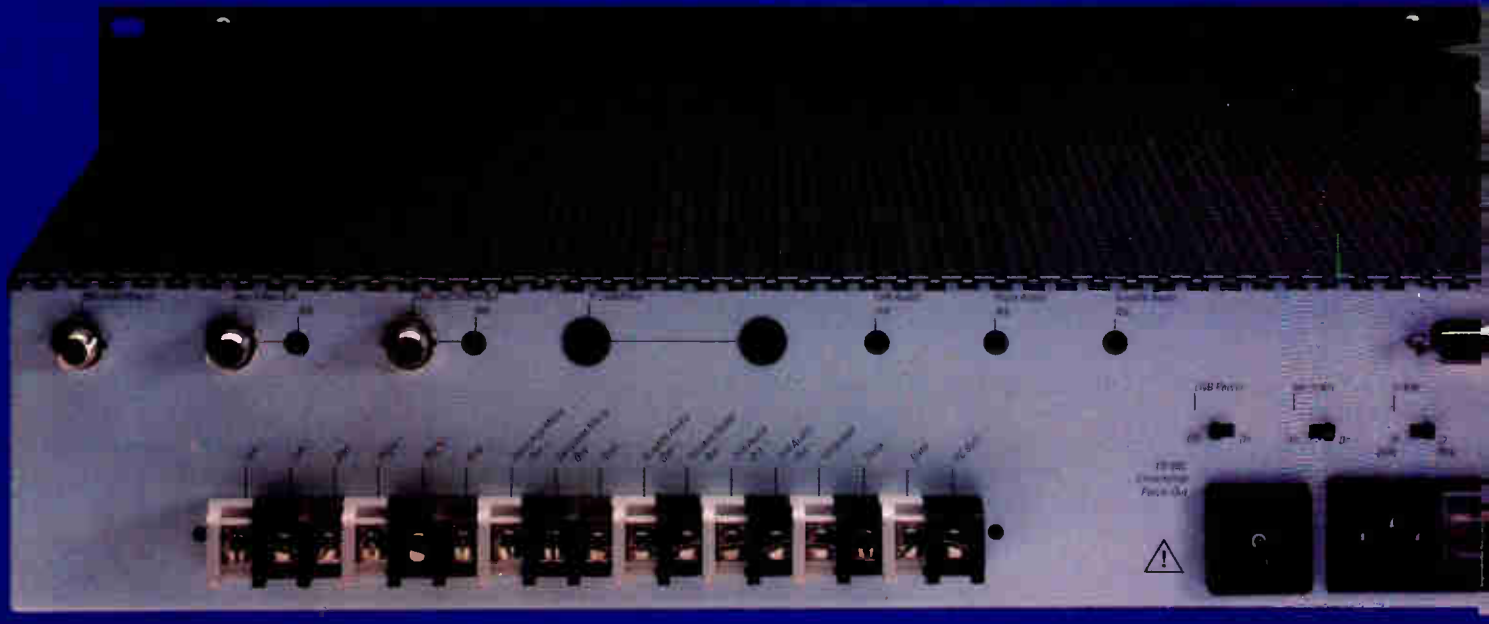

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Figure 1a. Signal flow under normal conditions

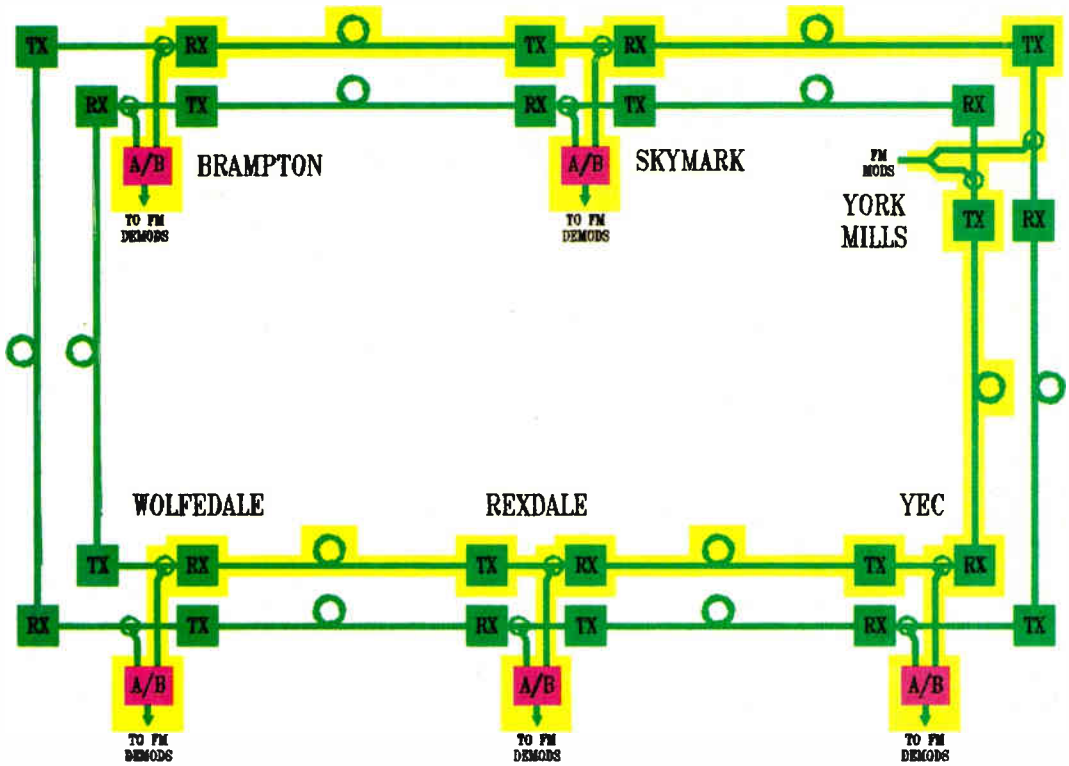

FIGURE 1(B): SIGNAL FLOW UNDER BACKUP CONDITIONS

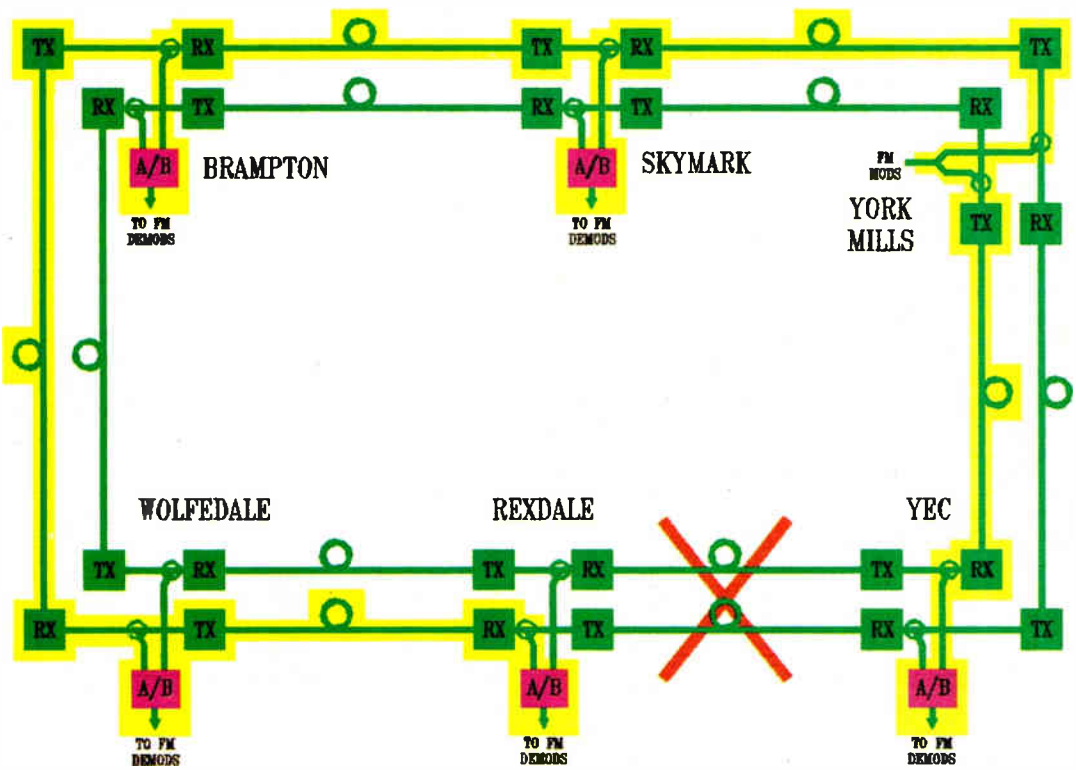

Figure 1b. Signal flow under backup conditions

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grouped and are best served by primary hubs via AM on fiber. This grouping is necessary to achieve a maximum fiber path length of 15 km to all hubs. This limit is imposed to support AM links with 56 dB CNR and 15 channels per fiber.

The primary hubs are served by a backbone fiber network that employs either digital or FM carriage of the video signals to deliver 60 dB signal-to-noise ratio. Due to its critical nature (it serves essentially 100 percent of all subscribers), redundant routes are utilized to ensure continuity of transmission should a path failure occur. Figure 1a illustrates the ring configuration used for the Toronto system. Each primary hub may launch signals for delivery to any other hub(s), so a distributed headend is effectively created. All hubs receive a total complement of signals on each of two feeds.

The signal flow path illustrated is that for signals originating at York Mills. In the event of fiber breakage, the redundant paths are used to serve affected hubs, as illustrated in Figure 1b.

The signal processing at each primary hub is illustrated in Figure 2. Fibers are depicted entering the hub from two directions, referred to as East and West. Several receivers and transmitters are connected to fibers for each direction as it is assumed that several fibers are required to provide sufficient capacity for the number of signals to be carried. The following points further explain the generic structure depicted.

- A set of broadband A/B switches selects between East or West signal feeds as required for normal or back-up

FIGURE 2: PRIMARY HUB PROCESSING

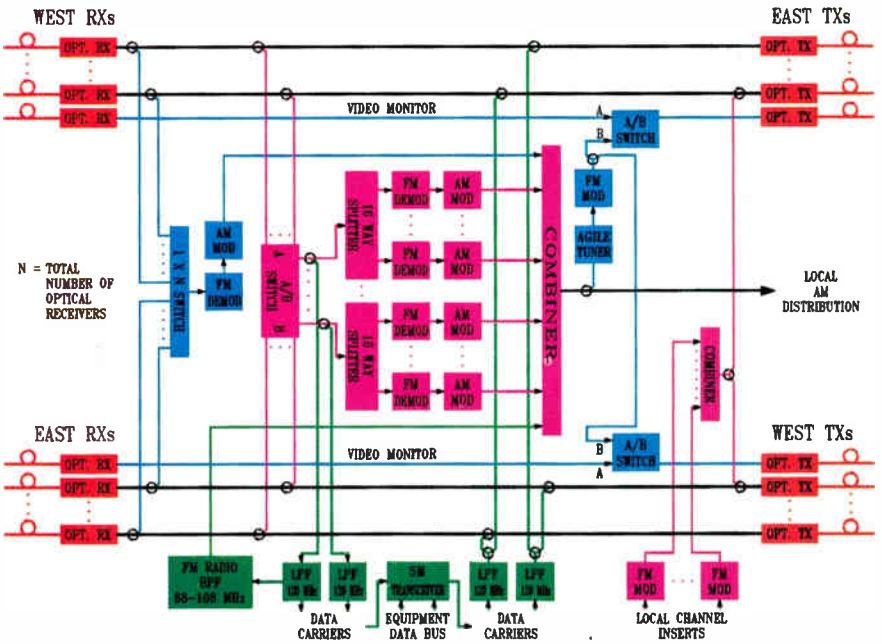

Figure 2. Primary hub processing

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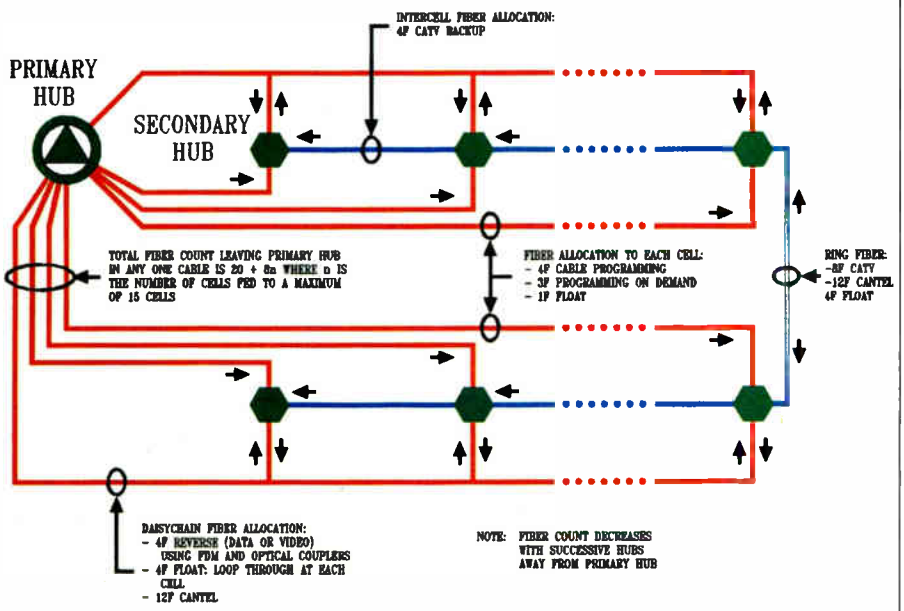

Figure 3. Redundant ring connection of hubs

operation. A splitter for each broadband switch output delivers signals to each of the FM video demodulators, which are remotely tunable. Remote tuning facilitates substitution switching of programs from the control center at 855 York Mills.

- Each broadband switch output is tapped for serving RF data modems or accessing FM broadcast signals in the 88 MHz to 108 MHz band. Data carriers are envisaged on each fiber link, frequency division multiplexed below 120 MHz and approximately 15 dB lower than the video carrier levels. Similarly, optical transmitter inputs have couplers to allow insertion of data modem RF carriers or FM broadcast signals for both East and West transmissions.
- All signals available from the optical receivers, whether from East or West, are switched to a spare agile FM demodulator and agile AM modulator for monitoring purposes. This equipment also serves as back-up to the normal complement of FM-to-AM conversion hardware described below, and is therefore fed to the combiner for launching onto the distribution network. In order to achieve the desired hardware back-up described, it is necessary to be able to remotely mute the ouput of each AM modulator. In this way, the agile FM-to-AM conversion equipment can be tuned to replace on-channel any set of defective FM-to-AM conversion hardware.
- Each video signal to be delivered to a primary hub via the backbone fiber network is demodulated to composite baseband, complete with 4.5 MHz audio subcarrier. The composite signal is then AM modulated and available as VSB AM at the IF frequency of 45.75

MHz. An upconverter transfers the signal to its on-frequency assignment. The output of the upconverter can be muted remotely via the status monitor and control system. This is required to allow the agile upconverter to replace a failed unit or achieve substitution switching.

• A remotely controlled agile AM tuner receives signal from a tap off the combined AM output of the primary hub electronics. The IF output of the tuner is connected to a FM modulator capable of transmitting vestigial sideband AM signals by first downconverting the IF to a lower frequency. Remote monitoring of any AM channel is achieved by selecting the appropriate AM tuner frequency. The output of the FM modulator is inserted onto both Eastbound and Westbound dedicated fibers via A/B switches for delivery of the selected channel to 855 York Mills. The FM modulator output is normally muted to allow shared use of the same spectrum by all hubs. Only the hub being monitored transmits a signal on this shared spectrum. The performance of the equipment to transmit the VSB AM envelope to 855 York Mills must meet RS-250B short haul specifications.

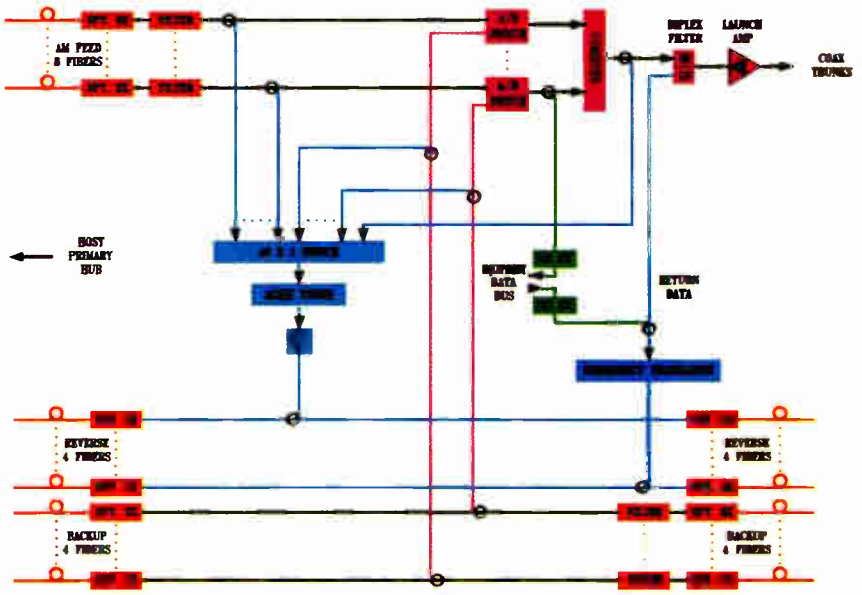

Figure 4. Secondary hub processing

• Video signals originating at any hub are FM modulated and inserted onto fibers both Eastbound and Westbound. A unique fiber and frequency allocation is made for each signal since all signals must reach all hubs via two separate paths without requiring notch filters to prevent collisions.

Secondary hub interconnect

Each primary hub serves approxi-

mately 15 secondary hubs. Each secondary hub serves an average of 10,000 homes. The signal format leaving the secondary hub is AM, initially on coax trunks and eventually on fiber. The secondary hubs are connected in a number of rings with typically five to eight hubs per ring. The conventional CATV broadcast signals are delivered on four dedicated fibers to each hub. This connection scheme is illustrated in Figure 3. A further four fibers per hub have been allocated for future services, such as programming on demand and a spare.

A hub-to-hub allocation of four fibers has been made for redundancy. Should the normal path be severed, the broadcast signals can be fed to affected hubs from the opposite direction, albeit at reduced quality. A failsafe switch senses the loss of primary feed and connects the hub to the alternate signals available. Hubs are spaced approximately every 3 km, which corresponds to fourth level cellular telephone cells. The low optical loss between hubs means that a transmitter at a primary hub will be able to serve a number of secondary hubs. Similarly, transmitters are not required at every hub to supply backup signals to its neighbor. Rather, a total loss budget of 12 dB is allowed in the backup path which accommodates several hubs, with couplers at intermediate hubs, before retransmission is required.

In addition to CATV signals, the hub interconnect cable supports the requirements of the Cantel cellular telephone network with 12 daisy chained fibers. There are also four reverse data and four spare fibers in the daisy chain. One immediate application of the reverse fibers is the carriage of status information from the terminal equipment at each hub to the primary hub.

A block diagram for the secondary hub is shown in Figure 4. Redundant fiber paths are illustrated, with receivers allocated to each. A multiple input switch allows any signal delivered to the hub to be monitored via the agile tuner. The output of the tuner is switched onto the reverse fiber under the control of the status monitor system and delivered to the host primary hub where it is connected into the video monitoring hardware.

A set of A/B switches selects the back-up fiber paths in the case of failure in the normal link. A combiner and diplex filter prepares the AM video signal for delivery to a launch amplifier and injection onto coaxial trunk cables. The 5 Mz to 30 MHz return signals are upconverted to a clear area of spectrum and combined with other return data onto the reverse fibers for delivery to the primary hub.

Signal quality requirements at the secondary hubs dictate that the transmission path from primary hub to secondary hubs exhibit a signal-to-noise ratio of 56 dB for the CATV signals. It is anticipated that the terminal electronics of the secondary hub will fit into one rack.

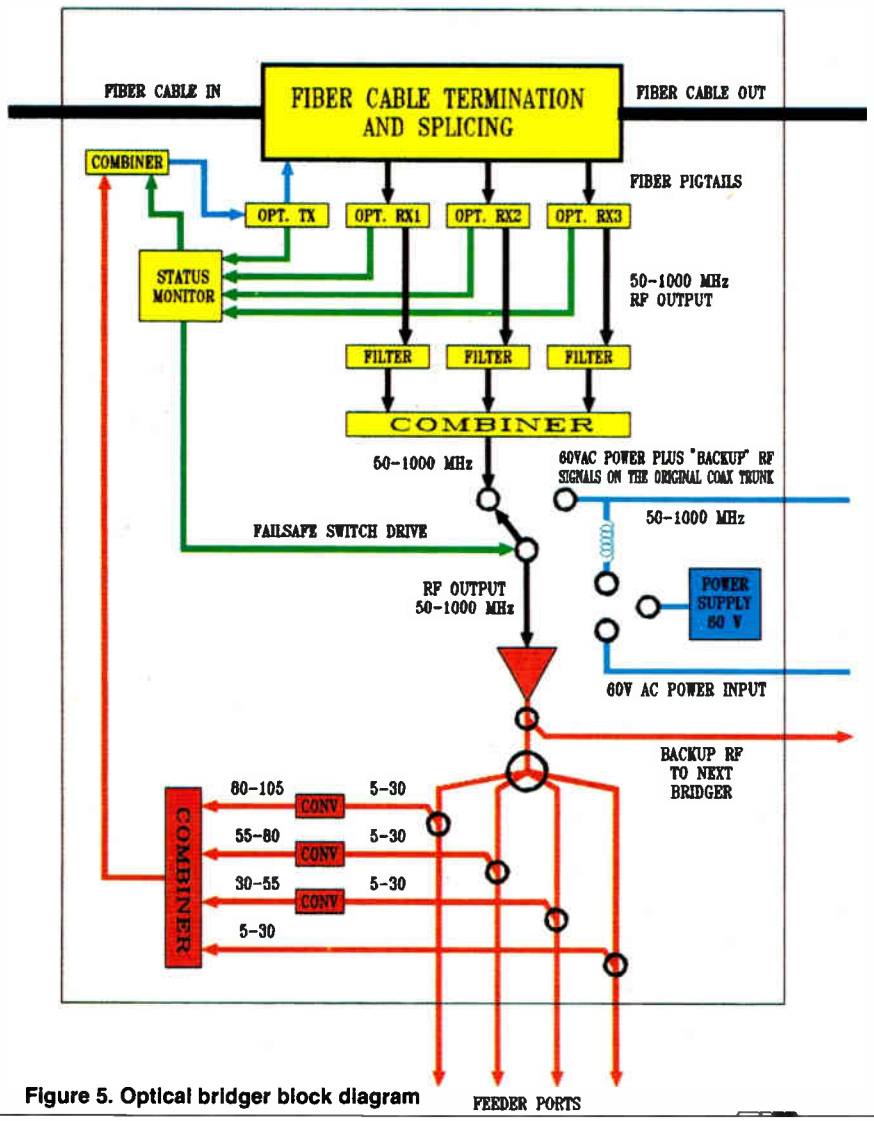

Figure 5. Optical bridger block diagram

Optical bridger

When the need to expand capacity beyond 80 channels occurs, probably after 1993, it is anticipated that fiber will be extended beyond the secondary hubs to serve individual bridger locations. A fiber-to-coax interface device, termed the optical bridger, will be located at each conventional bridger amplifier, served by four dedicated fibers and launch up to 150 channels onto coaxial based distribution plant to deliver signals to approximately 200 homes. Figure 5 illustrates the functional elements for an optical bridger.

Provision for four fiber terminations are made to support both receivers and a transmitter within the optical bridger. Delivery of 150 channels requires that each receiver process 50 channels which are subsequently combined. The launch amplifier may be either a single block as depicted or each receiver output could be amplified separately and then combined. The decision is one of economics for the level of performance required. It is currently believed that the AM link

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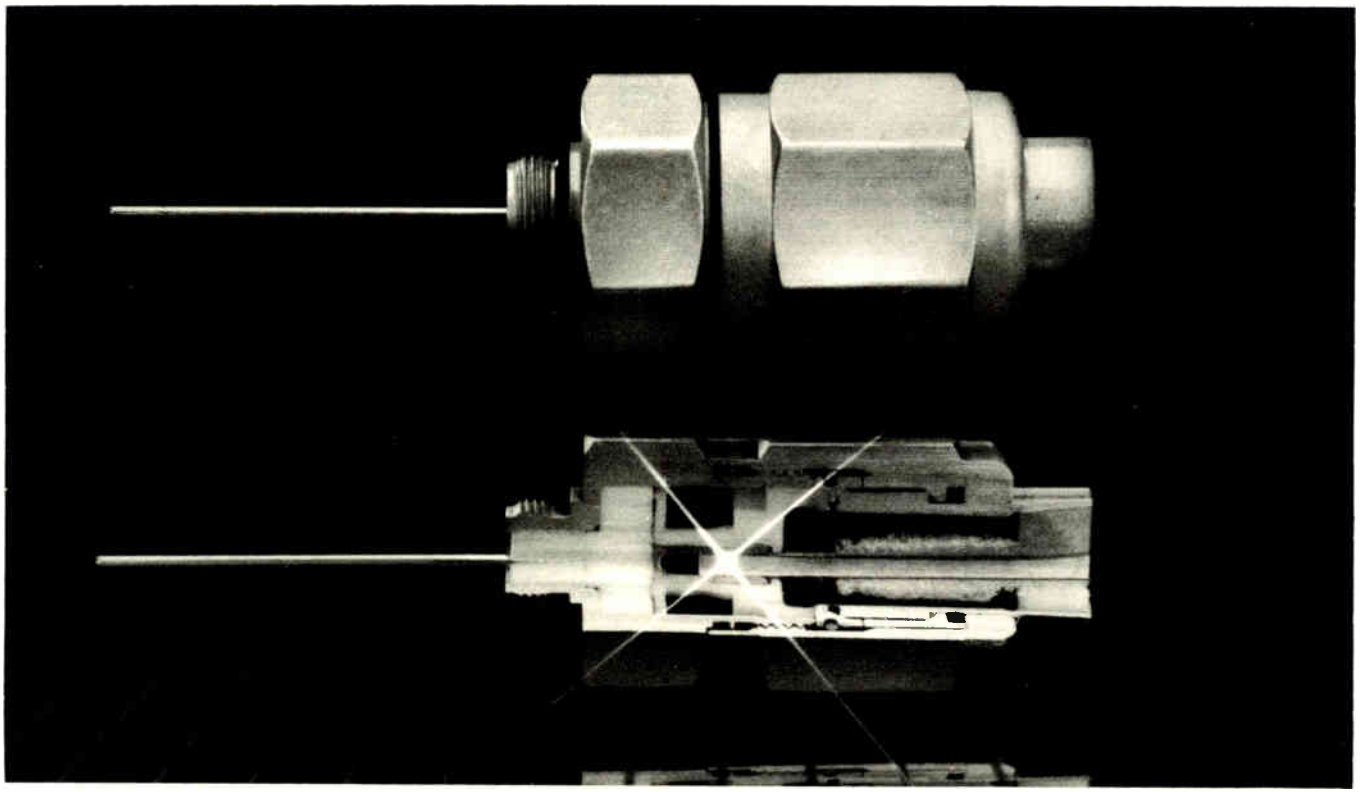

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performance to the optical bridger will need to meet a carrier-to-noise ratio of at least 55 dB.

An A/B switch is incorporated to allow back-up support to the fiber based equipment by using the existing coaxial trunk cable. Performance will be inferior to be sure, but at least limited service will be maintained in the case of failure. Status monitoring equipment in the optical bridger is consistent with the Rogers' philosophy of a comprehensive system to maintain high quality and reliability.

Signal loss is detected by the monitoring electronics and switches the A/B selector to the back-up path.

Interactive subscriber data is separated from the feeder cables and combined with a status monitor signal for upstream transmission via a laser transmitter. Upconverters may be added, as shown, to augment the signal carrying capacity in the upstream direction.

Powering for the optical bridger may be via the existing trunk cable or through a separate powering port. In either case, conventional 60V AC powering is envisaged.

High capacity/reliability feeder

With the fiber network able to deliver 150 or more channels to the bridger locations, it is necessary to devise a feeder architecture with commensurate transmission performance and capacity. The "Superdistribution" concept used by Rogers fulfills this requirement. Superdistribution (See Figure 6) uses a combination of forward-feeding and backward-feeding the multitap cascades via directional couplers at the output of the bridger and line extender amplifiers. The bridger output and each line extender are directly interconnected by pure 500/625 distribution cable in a mini-trunk configuration. This arrangement permits line extender AC powering without the necessity of current flowing through the multitaps and their internal chokes. As the flat loss of multitap attenuation is removed from the line extender interconnection, existing line extender spacing can often be maintained, even for plant operating close to 1 GHz.

This plant configuration is substantially more reliable than that of a conventional tapped feeder line as it avoids the most common faults which are power related i.e. fuses, short circuits, hum, intermittent connections, etc. It also provides a much flatter frequency response with far fewer reflections which should be advantageous for the distribution of advanced television signals.

One way to quantify the improvements inherent in this revised feeder design is by counting the number of connectors a signal must pass through prior to reaching the customer at the extremity of the feeder. Traditional tapped feeder would have 48 connectors between the bridger and extremity while the revised architecture features 23.

This revised design has some unique benefits in coping with non-linear distortion performance should the appropriate line extender amplifier be used. The required output level from one line extender to feed the pure cable interconnecting the second line extender is far lower than that traditionally found in feeder area designs. The only high level needed is that to drive the short tapped spurs. This could be accom-

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FIGURE 6: HYBRID FIBER/COAX TOPOLOGY

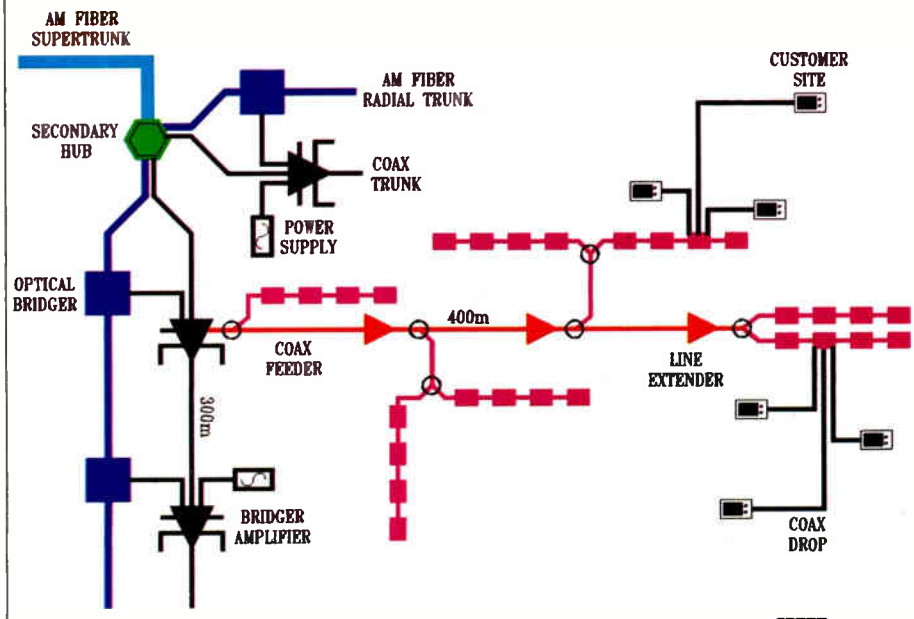

Figure 6. Hybrid fiber/coax topology

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plished via a second hybrid chip operating at the traditional line extender levels. The high level port is outside the cascade so distortions from this separate chip do not accumulate in a two- or three-line extender cascade.

The inherent derating in this configuration is very beneficial when trying to achieve 150 channel loading on 1,000 MHz plant with present day technologies.

Finally, without the need to pass AC power, the multitaps themselves no longer require power passing chokes which substantially simplifies achieving a low loss very wide bandwidth unit. Those designers wishing to achieve 450 MHz plant from existing 300 MHz feeders may find they can do this by removing the chokes from existing multitaps.

The superdistribution configuration generally cascades a maximum of four taps which already minimizes cascaded loss and removal of the choke extends the bandwidth. Field experience has shown 300 MHz taps modified this way can reach close to 500 MHz with certain multitap types. ■

Acknowledgements

The authors wish to thank their colleagues at Rogers Engineering for their contribution to the development of the fiber architecture described in this article.

The *World of Cable* TV Print was introduced and distributed at Cable '89 in Dallas, May 21-24, 1989. The 24" x 36" poster, suitable for framing, was sponsored by the participating companies and produced by Access Media, Inc.

To order copies of the Print, send $10.00 each plus $2.50 for shipping and handling to:
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Reader Service Number 42

Battery standards for CATV standby powering

The reliability of cable television signal distribution systems is increasingly dependent on the reliability of 60 volt A.C. power backup. The decreasing quality of utility power, and increasingly frequent interruptions in delivery of power add to the list of challenges to the cable system engineer in his efforts to improve service to subscribers.

Manufacturers of standby power supplies have traditionally left the decisions on selection, installation and maintenance of the battery sub-system to the cable engineer. Without standards of quality, a clear definition of the requirement, and with potentially unrealistic expectations respecting battery service life, the industry has experienced wide variations in performance and reliability of its standby powering equipment.

It is the object of this paper to lay groundwork for establishment of a process leading to the creation of standards for battery usage in the CATV standby power application. The paper reviews the nature of the CATV standby power battery service requirement, and compares this requirement to available classes of battery service. The special needs relating to temperature, environment, price/performance and maintenance are discussed, and comparisons made within two main battery types.

The paper concludes with recommendations affecting the use of AGM (absorbed glass mat) batteries and Gelled Electrolyte batteries.

Standby power battery requirements

Size, voltage rating and discharge capacity. Typical standby power supplies in CATV use a 36 volt D.C. inverter as the back-up source. Some designs remain that use a 24 volt source, although these have largely passed from common usage. Dual parallel battery strings are in use where higher capacities are required to support longer run times. The "standard" 3-battery series-connected 36 volt hook-up will be the example used throughout this paper. At typical run times of 1.5 to 3 and 4 hours, at 60 VAC loadings of between 7 and 12 amps, battery sizes in the "group 31" case size offering capacities of greater than 150 minute reserve capacities are commonly used. Batteries commonly produced for the automotive, traction and marine markets suggest themselves for this application, and are widely available in the capacity range indicated.

By Larry Lindner, Bob Bridge, Alpha Technologies and Charles Marks, Johnson Controls

Charging requirements.

1) **Float service.** The standby power supply battery must be continually maintained at a state of full charge, in anticipation of a discharge cycle at unpredictable intervals. Float service is commonly used by power supply designers. A constant-voltage float is impressed permanently across the battery string. Current flow into the battery string is determined by the total battery series impedance, a function of charge level. At the correct float voltage, a fully charged string of three batteries will continuously draw only a small amount of replenishment current to compensate for ongoing self-discharge. At any level of discharge, a demand current proportionate to the required charge will be drawn from the float charger.

2) **Temperature variation.** The standby power battery will be used in outdoor enclosures and is therefore subject to most environmental conditions. The most important of these will be temperature variation. The battery will be required to charge effectively, to retain significant discharge capacity, and to provide reasonable service life over a wide range of temperatures. Temperatures will range from extremes well below zero degrees to high values in the 120-degree to 135-degree range. Float charge systems must be temperature compensated to avoid overcharging at high temperatures, and to avoid inadequate charge levels during periods of extreme cold.

3) **String, charging.** The 36 volt inverter battery comprises three 12-volt batteries in series. Use of a single charger to float the three batteries at equal voltages requires that the single float voltage value be divided across three equal-impedance batteries. This requires that the batteries be of identical production, identical age, and in identical condition. Variations between batteries, or early failure of a cell within a battery, will unbalance the charge voltage distribution, usually resulting in overcharge of the remaining batteries. Batteries produced with low-cost materials, and/or in a poor quality-control environment, may have inherent imbalance conditions even when fresh from production. Carefully matched batteries, known as "UPS Grade," have been considered outside the price range of CATV budgets.

Discharge service. Cable back-up requirements come in unpredictable spurts, depending on local conditions of weather and utility reliability. Outages may occur typically for very short periods on average, but on occasion may be lengthy. National averages have been reported to be in the 20 minute range, but outage classifications within CATV have not been standardized. Outages of seconds, or minutes in duration, are common. During periods of storms, extreme lightning activity, or severe winter weather, outages may last for days.

Battery back-up is normally expected to provide inverter power for up to two hours on average at typical loads. Many CATV franchise agreements today call for four-hour run times, but these are largely unrealistic and in any case are seldom referred to a required amount of load power.

Discharge events can be said to be at random intervals, of widely varying duration. For events which last longer than available capacity, the battery may remain without charge for the duration of the outage until restoration of power by the utility or generator. These events may be at extremes of temperature.

Discharge current levels. Standby power supply rated load values are currently in the 10 amp to 28 amp A.C. range. This translates to power requirements in the 700 Watt to 1,800 Watt range, at 36 volts D.C., when the inverter is called on to support cable loads and operation of the power supply circuitry. For a 36 VDC string, dis-

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charge currents will therefore be in the range of 20 to 50 amps. By far the majority of standby power supplies will operate in the 12 amp A.C. output range, (at 60 VAC), calling for a 23 amp average discharge current level from inverter batteries. "Cranking" ratings, given as "C.C.A.," or "cold cranking amps," describe short-term discharge ratings for batteries used in automotive starting applications. For standby service applications, most 12 volt batteries in use today are rated for "reserve capacity," in minutes, at 25 amps discharge. The reserve capacity rating then, is almost directly equivalent to "standby time" attainable at average CATV loads. Batteries used in cable should be compared on the basis of reserve capacity, not "amp-hour" ratings or C.C.A. figures.

Vibration environment. Batteries in most CATV applications are mounted on poles in enclosures at 10 feet to 20 feet off the ground, or on concrete pad-mounted enclosures. These are all in direct contact with traffic-generated vibration on cable rights of way, and this vibration is relatively constant. Occasional "whipping" or jolts due to falling ice, high winds or adjacent use of heavy equipment may be experienced. Mechanically, the environment is not exceptionally stable.

Maintenance environment. Maintenance of line equipment and subscriber connections tends to dominate the time of the outside plant maintenance staff. Power supply familiarity and battery test procedures are generally low on the priority list of many cable technicians. This can lead to low levels of understanding of the role of the battery in the standby equation. On the plus side, training programs from vendors and a growing sensitivity to power protection is rapidly improving maintenance levels focused on standby power supplies. Progressive cable operators, using optimum maintenance schedules, may direct field technicians to visit power supplies quarterly or even more often, but correct procedures relative to checking battery health remain somewhat hit-and-miss. Virtually no directives exist which mandate removal of batteries from service until after the power supply ceases to function. It appears that battery *failure* is the only symptom that is universally recognized as indicative of the end of service life.

Battery chemistry review

The lead-acid battery, in common use for over a century, in size, price, and capacity ranges suited to the CATV application, are considered in this paper for their suitability. A review of lead acid chemistry follows.

The chemical reaction between lead dioxide (PbO_2), lead (Pb), and sulfuric acid (H_2SO_4) provides the lead-acid battery's energy. The electrolyte, which is a 1-to-3 solution of acid in water (under full charge) at 77 degrees Fahrenheit may be in free liquid (flooded cell), finely distributed into a fibrous absorbent carrier (absorbed glass mat), or suspended in a mineral gelling material (gelled electrolyte). The "active" material of the positive electrode is the lead dioxide, and the active material of the negative electrode is metallic lead (Pb). Both active materials are present in the electrode structure as paste, mounted in a metallic lead frame or "grid" structure. The pastes are porous to facilitate the required amounts of surface area needed to support anticipated discharge currents.

On discharge, the active materials are converted to lead sulfate ($PbSO_4$) which is deposited on the grids. The sulfuric acid solution turns to water (H_2O) as the sulfate is consumed and water is produced. During recharge, particles of lead sulfate are converted back to sponge lead at the negative electrode and to lead dioxide at the positive, by the charging source driving current through the battery. The well-known reaction is:

$$Pb + PbO_2 + 2H_2SO_4 \rightleftharpoons 2PbSO_4 + 2H_2O$$

Lead + Lead Dioxide + Sulfuric Acid ⇄ Lead Sulfate + Water

discharge/charge

Battery construction review

Grid alloys. Lead alloy grids are used to mechanically support the active electrode material. Grids are produced from cast lead, or lead sheet. As pure lead is too soft for grid material, alloying materials such as calcium or antimony are added. Antimony, in 4 to 6 percent amounts, tends to dissolve from the positive plate and redeposit on the negative plate. This affects operating voltage, increases water consumption and reduces life as the antimonial battery ages.

Calcium was first used in telephone battery applications as a hardener. Service life was lengthened, and less frequent watering was required. Amounts vary from 0.03 percent to 0.10 percent.

Grid pastes. Lead oxide pastes applied to grids by hand or machine contain measured amounts of a mixture of lead oxide, sulfuric acid and water. Fibrous additives may be present for increased strength and binding ability. Expanders may be used to increase porosity, and subsequent current-supporting surface area.

Pastes with low density (high porosity) are used in high-rate shallow discharge service. Pastes where a deep discharge is required at relatively low rates need to be higher in density (less porous). Deep discharge stresses the paste material as it grows during discharge on the grid structure. These stresses will work to loosen the paste material from the grid. High density paste will hold onto the grid through the stress of deep discharge. Each deep discharge cycle of the battery will work to weaken the paste-grid bond, and batteries in deep-discharge will be cycle-life limited.

The paste curing process during production helps to determine its service characteristic. Flash drying after initial pasting, and subsequent lengthy cures at specific temperatures and humidity levels will determine paste-grid bonding and paste densities.

Battery assembly. Positive and negative plates are electrically insulated from each other by separators. Separators include PVC, phenolic/celluloid, microporous rubber or polyolefin. Some sealed batteries use glass fiber mats. Separator materials are porous or permeable to allow ionic conductivity. Current flow through separators will be a function of pore size in the separator: internal impedance then, is partly a function of separator material. Separator types can have a dramatic effect on service life.

"Formation" of the battery is the initial charging of the assembled unit. Electrolyte is added to the battery and charging current applied. During this process, the sulfuric acid in the paste material transfers to the electrolyte, resulting in a final specific gravity higher than that of the electrolyte added.

Battery service categories

In producing batteries for different types of service, the production parameters such as grid size, alloys used, paste mix, paste density, paste cure,

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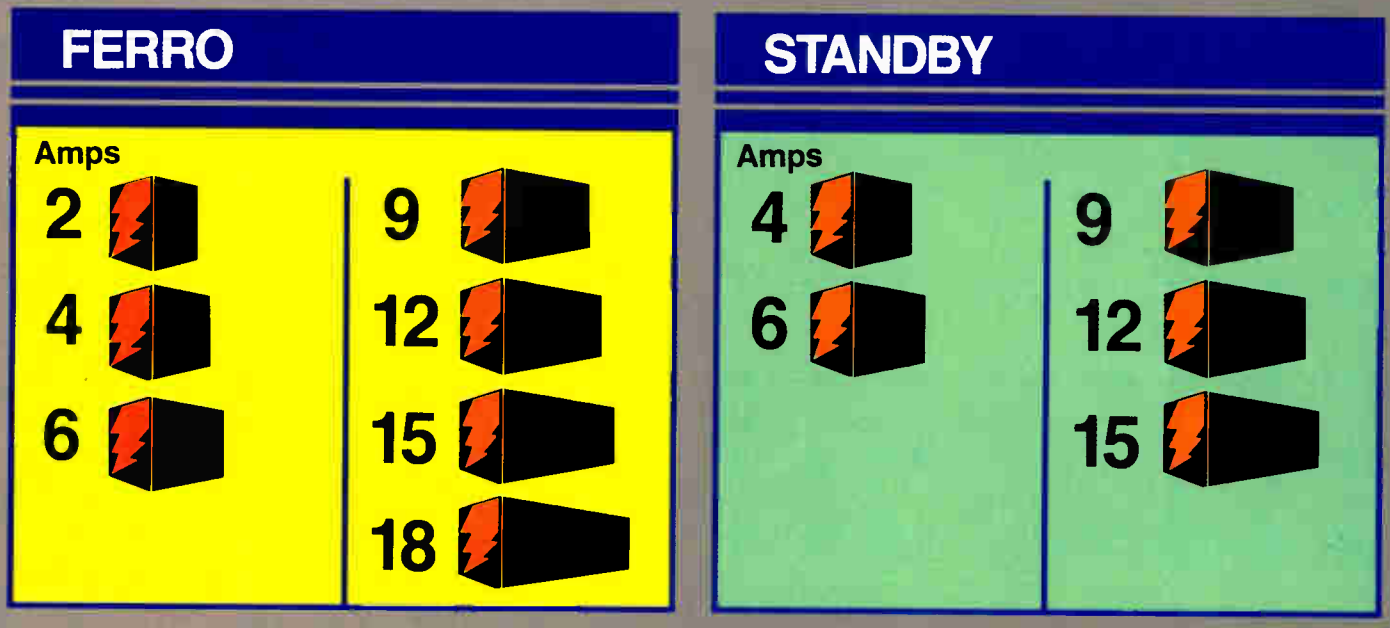

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separator material and the internal physical dimensions of the case may all be varied and optimized. The service requirement will be dictated by parameters of capacity, cycle life, "float service" life, cost and discharge depth. The majority of 12 volt lead-acid storage battery service requirements have been divided into three classes of service: "SLI" or "starting-lighting-ignition," "deep cycle," or "traction" batteries, and "stationary" batteries.

SLI batteries. An ability to deliver maximum amounts of current in minimum amounts of time characterizes this category. The automotive starting application is the most familiar use for this type of battery. The battery design and construction is therefore optimized for low impedance by maximizing plate exposure to electrolyte. This calls for thin plates (to maximize the number of plates) and low density (porous) active material. Discharge depth is typically shallow, as perhaps only one percent of the battery's total capacity is taken off during a typical "short burst" discharge in a starting application. If deep discharges are taken off of an SLI type battery, very few cycles will be available, as the paste-grid bond is severely stressed by the electrode growth during the discharge. The thin plate structure and porous paste will be seriously weakened by deep cycling. SLI batteries are also characterized by low-cost materials and economic construction.

Deep cycle batteries. The deep cycle application implies discharge cycles to as much as 80 percent of the capacity of the battery. The use of thick grids with high paste density is required to support the stresses of discharge to these depths. Premium separator material is usually required, with possible additional use of fiberglass mats, to assist in support of the paste material on the grids. Reduced surface area of plate to electrolyte contact will increase internal impedance and reduce values of discharge currents.

Stationary batteries. Batteries which are required to support lengthy discharges (up to 8 hours) and long life in service, particularly in the 48 VDC battery plants used by telephone company central office equipment, have come to be known as "stationary batteries." These units are normally racked in place, and are typically high-quality flooded designs using premium materials and high-quality construction methods. These batteries are assembled with much more care than automotive or deep-cycle products. Stationary units typically are rated for 20 year life on float service.

Sealed batteries. All three of the main service categories may be produced in sealed designs. Sealed batteries are designed to eliminate the need to add water, increasing the convenience and safety to the user.

Flooded batteries, typical of the SLI category, may be sealed if extra electrolyte is used to provide the additional reserve of water. Lead calcium grids should also be used in a sealed flooded model to minimize gas production. These units are normally supplied as "maintenance free" batteries in the SLI market.

AGM batteries, or "absorbed glass mat" products are also known as "starved electrolyte," "acid limited" or "recombinant" batteries. In this sealed lead-acid product, a mat of fine glass fiber material functions as a plate separator with up to 95 percent void volume in the mats. The mat acts as a "sponge" to hold electrolyte between the plates. About 95 percent of the void volume is filled with acid, leaving residual volume for gas transfer during recombination. H_2 and O_2 gases, freed

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from the electrolyte during discharge will normally vent to the atmosphere in flooded batteries. In the AGM product, these gases will recombine with the negative plate and the electrolyte during recharge, with virtually no gas production released to the atmosphere. An internal overpressure is maintained in AGM products to aid in recombination by retaining the gases long enough to recombine.

Gel batteries. Gelled electrolyte batteries function as starved electrolyte batteries, but do not use a glass mat. The high-density gel material takes on a porosity through development of "fissures" in the gel during initial formation and charging of the battery. Gas transfer during recombination then is facilitated by way of the fissures. Gel materials in common use are fumed silica, sodium silicate, boron phosphate and polymer microspheres. Gel products have exceptional shelf life. Self-discharge rates in storage may average 3 percent per month at room temperatures.

Battery charging. Charging methods for lead-acid batteries may be divided into: constant current; taper; pulse; trickle; and constant potential.

Constant current chargers force a fixed value of current through batteries on recharge irrespective of the state of charge of the battery. This can lead to overcharge. Trickle chargers are simply low-rate constant current chargers. Pulse chargers use current pulses which are periodically disconnected to measure open circuit voltage. Constant potential chargers (float chargers) deliver current in proportion to the charge needs of the battery. Float chargers need to be temperature compensated. Taper chargers are low-cost constant potential chargers.

As batteries are only about 80 percent efficient, more energy is delivered to the battery during recharge than is taken off during discharge. During the last 5 percent to 10 percent of recharge, a normal "overcharge" condition exists. Gassing occurs during this portion of recharge. In a flooded battery these gases are released to the atmosphere; in AGM or Gel products, gases are recombined.

Lead-acid battery failure modes

Loss of capacity. Normal end-of-life will be corrosion of the positive grid. Corrosion of the positive grid is the slow conversion of the lead alloy material to lead dioxide, resulting in a loss of support for the active material. As the grid material corrodes, its resistance increases. This increasing internal impedance is equivalent to decreasing capacity. As the grid corrodes, the lead dioxide material takes up more room than the lead alloy did: this is "positive plate growth." Without design for this expansion, internal shorts result. In designs where low impedances and high-rate discharges require thin, closely spaced plates, this type of failure mode is more likely than in low-rate, thicker-plate designs.

Thicker grids will obviously take longer to corrode away. Long-life batteries therefore are characterized by thick grids. Stationary batteries may have grids up to 0.30 inches. For similar capacity ratings, (say in the 160 minute reserve capacity category) an SLI flooded grid will be 0.030 inches to 0.040 inches in thickness, whereas gel and AGM products may be up to 0.115 inches. The AGM product, with the mat acting as electrolyte support, needs less room between plates for separator and electrolyte, allowing greater thickness to be used, resulting in closer plate spacing.

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discharge cycles, lead sulfate builds up on the lead dioxide plate material. Lead dioxide is a brittle, ceramic-like material, and is more dense than lead sulfate. This repeated expansion and contraction of the composite plate stresses the active material, causing it to break loose from the grids. Deep cycling obviously causes great stress. Deep cycle batteries may incorporate several layers of material or envelopes over the plate to retain the active material in place. Again, high density materials will tend to remain in place in the grid under the stresses of deep cycling.

Shorts due to dendrite production. Cell shorting can occur in several ways. Most commonly it occurs when the design has not allowed for positive grid growth. Cell shorting can also occur, due to "dendrite" formation, when batteries are very deeply discharged. Dendrites are conductive lead paths that penetrate the separator. Dendrites occur as the battery is discharged and the electrolyte specific gravity (S.G.) is lowered. Lead sulfate from the plates becomes more soluble in the low S.G. electrolyte. Upon recharge, this lead sulfate turns into metallic lead forming dendrites. AGM batteries seem to be more susceptible to this deep discharge problem as they are designed to be an "acid starved" system and to use up most of the sulfuric acid. The gelled product maintains a higher specific gravity which tends to inhibit lead sulfate solubility and resultant dendrite formation.

Accelerated grid corrosion. Positive grid corrosion occurs under all conditions in a lead-acid battery. The rate of corrosion is dependent on grid alloy charging voltage, temperature and electrolyte specific gravity. Improper float voltage, high temperature and elevated electrolyte S.G. will all increase the rate of positive grid corrosion. In general, AGM batteries operate at a slightly higher S.G. than gelled batteries to compensate for the limited electrolyte volume. If this type of battery is not designed with the slightly higher grid corrosion rate in mind, it will fail prematurely, particularly at higher temperatures. High float voltages that increase grid corrosion point out the need for proper temperature compensation.

Sulfation. Normal production of lead sulfate during discharge is converted to the usual reaction products during recharge. If batteries are left to stand on self-discharge and experience lengthy periods of stand-time at partial charge levels, a hardening of the lead sulfate sets in, which is much more difficult to break down on recharge. This hard sulfate acts to close the "pores" of the active material. Obviously batteries should be charged as soon as possible after discharge. Sulfation is accelerated at elevated temperatures. Sulfation can be reversed somewhat by sustained overcharge, to break down the sulfate material. This will produce excess gassing and is not recommended for sealed batteries. Excess gases in sealed batteries will be vented by pressure-relief valves, resulting in reduced battery life.

Sulfation is also enchanced by low electrolyte level in flooded batteries (at the exposed tops of plates), higher specific gravities, and higher operating temperatures. Continuous undercharging due to inadequate float voltages or inadequate temperature compensation will increase sulfation rate.

Operation at elevated temperatures. The chemical processes at work in all lead acid batteries will proceed more rapidly as a function of increasing temperature. The rule of thumb is "..for every 15 degrees Fahrenheit of continuous operating temperature over 77 degrees Fahrenheit, battery life expectancy will be halved.." This implies that a battery with an estimated 60-month life at room temperature will have a 30-month life if operated continuously at 92 degrees Fahrenheit. At 107 degrees Fahrenheit, the anticipated life is reduced to 15 months. Battery life can be maximized through operation at reduced temperatures, and with correct temperature compensation of charging current.

Conclusions

It is evident to CATV engineers that a sealed-construction battery is first choice for the standby power supply application on grounds of ease of handling, safety, UL approvals and local electrical codes. Flooded batteries are to be avoided due to hazards in shipping, transporting to power supply locations, warehousing, disposal and lack of approval by UL or local jurisdictions for use on poles or in ground-mounted installations on public rights-of-way.

The choices are reduced to gelled electrolyte products or AGM products, which have been made available in the capacity and price ranges compatible with customary cable industry budgets. This reduces the choice to sealed, non-flooded products aimed at deep-cycle ("traction") applications and stationary applications.

AGM or gel products with thick plates, designed for potentially lengthy discharges without cycle damage will be suitable candidates for use in the CATV application. The greater susceptibility of the AGM product to accelerated corrosion, dendrite growth, plate growth and capacity reduction, with all of these increased at higher temperatures, will result in shorter service life for this choice.

AGM units will be economic choices in cooler, or relatively constant room temperature environments. The gel product should offer lengthier service life, all things being equal, as it appears less susceptible to the processes leading to failure. "Dry-out" of the gel product due to sustained overcharge at elevated temperatures has been reported as a common failure mode of this battery type in power supplies without temperature compensation circuitry.

Imbalances in internal impedances due to production process variations can be expected to have equal effects on both types. The lower production cost of the typical AGM product relative to the gel product suggests more proneness on the part of the AGM to variations between individual batteries in a given production run. Gel products now made for long life stationary battery applications can be expected to have tight quality control content and higher quality materials used in construction than AGM's manufactured for trolling motor markets and subsequently marketed as CATV standby power supply batteries.

Prices of AGM products made for mass markets have been a significant attractant for tight CATV budgets. Typical purchases have been driven by "price per unit," with little regard for service life. Simple arithmetic points out that a battery product with a typical two-year service life supplied to the market at (say) $75, will have an annual amortization of $37.50. Another product with a potentially longer service life of (say) three years, at pricing of $85, amortizes at $28.33 per year. When price/performance comparisons of service life are made in this way, the "more expensive" product may be up to 25 percent less costly in the long run. ■

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1. Hans Bode, "Lead-Acid Batteries," John Wiley & Sons

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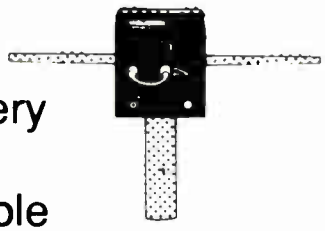
RD-1



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Receiver requirements for cable leakage measurements

For the next 12 months, CED *will feature one article per issue devoted to the subject of cumulative leakage index and the July, 1990, compliance requirements. Specific questions or topics you would like to see featured are invited.*

Receivers used in making cable leakage measurements have to meet certain performance criteria. These performance criteria are due to the unique requirements of dealing with cable leaks. The design requirements of the receiver are far more detailed than the system requirements of the receiver since they are interrelated. However, the overall performance of a receiver can be determined from the data sheet once some of the system considerations are known.

The receiver specifications which are of interest include frequency coverage, sensitivity, measurement dynamic range, selectivity, intermodulation performance, stability, signal identification and field-strength readout.

The requirements for each specification are a combination of two influences. First is the real-world situation which a cable leakage technician will encounter while maintaining the cable plant.

The second influence on the specifications of the measurement receiver is Part 76 of the FCC rules.

Frequency coverage. Part 76 requires that the aeronautical bands are protected. These include the 108 MHz to 137 MHz and 225 MHz to 400 MHz bands. While these are the frequenices of concern in the eyes of the law, a cable operator cannot interfere with any service which occupies the same spectrum.

There is considerable frequency dependence upon the nature of the leak. Leakage at one frequency can be very high and nonexistent at an adjacent channel. The actual leak and the parasitic coupling to other radiating elements such as power and phone lines is unpredictable. A receiver which covers as much of the cable spectrum as possible will ensure that all the frequencies are protected and provide a good diagnostic tool for effectively finding the leaks once they are detected. The cable technician can tune the receiver to the frequency which has the best leakage characteristic for finding the leak.

By Ted Dudziak, Project Engineering Manager, Cable Leakage Instruments, Wavetek

Sensitivity. The sensitivity requirement of the receiver is related to the field-strength measurement technique used. Part 76 specifies that a tuned half-wave dipole be positioned 3 meters from the leak and that the minimum leak is 20 μV/m. The half-wave dipole might be considered worst case as far as the pickup element is concerned. However, the 3 meter distance is not a very practical situation. It is an accepted practice to make a field-strength measurement at the actual distance and extrapolate the reading to the 3 meter distance. The conversion is made using the inverse relationship between distance and field-strength. For example, a measurement made at 30 meters will be 20 dB higher at the 3 meter distance.

Table 1

20μV/m terminal voltages with a dipole

Frequency	Antenna Factor	3 Meters	30 Meters
72	3.5	-37.5	-57.5
108	7.0	-40.7	-60.7
118	7.8	-41.5	-61.5
137	9.1	-42.8	-62.8
225	13.4	-47.1	-67.1
400	18.4	-52.0	-72.0

Table 1 contains antenna terminal voltage in dBmV versus distance for different measurement frequencies using a half-wave dipole. Note that the dipole antenna factor affects the terminal voltage.

These terminal voltages represent the minimum sensitivity required for a 20 μV/m field-strength at a 3 meter distance. A 50 μV/m field-strength measurement is required by Part 76. The higher field strength increases the terminal voltages in Table 1 by approximately 8 dB.

Dynamic range. The dynamic range of the receiver affects the measurement accuracy as well as the receiver response to high level signals. Although leaks of 18,000 μV/m are possible, measured values above 1,600 μV/m are moot. A single 1,600-μV/m leak will cause a CLI failure. A measurement range of 30 dB would cover the 50 to 1,600 μV/m requirement while a 60 dB detection range is necessary to cover 20 to 20,000 μV/m at the 3 meter distance. However, if the distance approximation is used to extrapolate the field-strength, then a 50 dB measurement range is necessary.

Selectivity. The selectivity performance of a measurement receiver affects the noise bandwidth, adjacent channel interference and spurious response.

The noise bandwidth can determine the minimum detectable signals level. In communications system design, a rule-of-thumb is that there is -144 dBm of noise power available for a 1 kHz of system bandwidth. Thus, a 75-ohm system and 30 kHz system bandwidth will give a noise floor of 0.5 μV. However, with techniques similar to those used in spectrum analysis the measurement range can be extended below the system noise floor. Additionally, the inherent noise figure of the receiver will contribute (4 dB to 8 dB) to the noise floor. Thus the entire measurement bandwidth of the receiver must be considered.

Adjacent channel interference can be a concern when making measurements within the aeronautical bands. Aircraft and tower transmitter power can be high enough to get through very selective bandwidths when trying to measure low level leaks. Fortunately, aircraft communications is intermittent even in the busiest areas and will allow measurement of low level leaks between transmissions.

Ideally, the receiver bandwidth should be narrow enough to reject the adjacent channel signals spaced by the offsets specified by Part 76. However, frequency tolerances of the headend modulators will be a concern so that a wide receiver bandwidth is desired, which allows a low enough noise floor to make adequate measurements. Stable pilot carriers can be used to give an ideal measurement reference, however, they are limited to that particular

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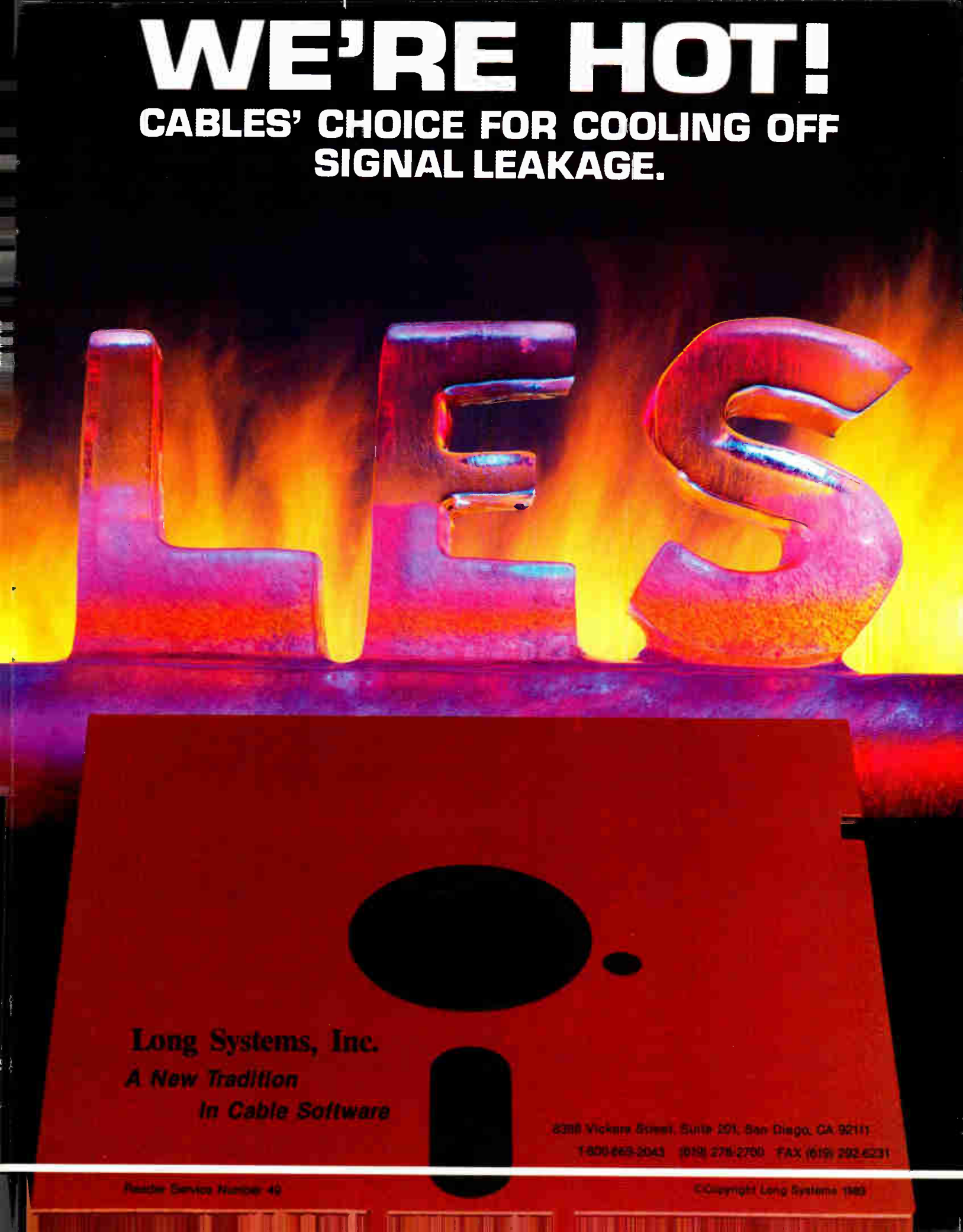

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frequency of operation or the number of additional pilot carriers that a cable system wants to put on its system. Additionally, pilot carriers usually have modulation impressed on them which forces the receiver bandwidth to be wider than if a single tone or carrier is used.

Spurious performance is affected by receiver bandwidth in that conversion products in the receiver need to be minimized by adequate rejection.

Intermodulation performance. Intermodulation performance is affected primarily by the input stage of the receiver. This is of particular concern for wide coverage receivers as well as any receiver used in areas where high level off-air signals are present. A wide coverage receiver will contain preselector filters and amplifiers which have high intercept points. Additional rejection of off-air signals can be obtained by using commerically available bandpass filters for the channel of interest.

Stability. Tuning stability of the receiver includes both frequency control and measurement accuracy. The narrower the receiver bandwidth, the more demanding the tuning stability requirements. If the receiver bandwidth is too narrow the receiver could drift out of the detection range and the patrolling activity be ineffective. Tuning adjustments provided on an instrument should not have to be continually readjusted to make a field strength measurement.

Measurement stability should be as good as most signal level meters. Additional errors due to the logistics of making the measurement will occur during the measurement process.

Other concerns. The receiver should have the ability to distinguish the cable signal with other off-air signals. Fortunately, the video signal has a unique signature within the aeronautical band. The use of positive and negative offsets can provide additional signal differentiation for adjacent systems. A pilot carrier with unique modulation provides good signal identification with the consequences discussed.

The readout of field-strength should be direct and without interpretation by the technician. A digital readout is ideal in that there is no influence by the readout device. Table 2 summarizes receiver requirements for maintaining control of cable leakage. ■

Table 2

Summary of receiver requirements

Sensitivity	< 0.5 µV
Dynamic range	> 50 dB
Selectivity	< 30 kHz
Frequency coverage	108 to 137 MHz and 225 to 400 MHz internal preselectors
Intermodulation	
Stability	frequency: correlated to cable source amplitude : ± 1.0 dB over temperature
Signal identifier	correlated to video signal AM and FM demodulators with speaker output
Measurement readout	digital for logging purposes and analog for locating the leak

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High profile investments in the cable industry

New tower structures in the cable industry have been few and far between over the last decade. The majority of tower work has been in the area of unstacking existing structures to lower heights or removal of structures all together. Most cable trade shows today sport only a single tower manufacturer where there were as many as ten represented in the late '70s. Each year a handful of towers replace older structures due to catastrophic occurrence or system rebuild.

Just when the tower industry seemed to be going the way of the buffalo and the Indian that hunted him, a modern application of technology is bringing towers back into cable's future. Dale Howard, construction supervisor for James Cable Partners, dba Southwest Cablevision, explains the need for new structures: "With the advent of the 40 and 50 channel systems, a cost effective way to provide top quality service to the smaller market had to be developed. It would not be cost effective to build a high dollar headend at each site when the microwave spectrum and technology exist to build one high quality site and share it with the smaller systems."

Another incentive was added in the form of ad insertion. Howard elaborates, "Many of the satellite stations like ESPN have advertising spots available for the system operator to sell local advertising on. The aggressive cable operator can greatly enhance its bottom line by taking advantage of this opportunity."

Because modern microwave technology is more cost effective than fiber optics in many applications, microwave supporting structures are a necessity. Although some of the existing structures are capable of supporting the microwave antennas required, most are not. The wise cable operator has stress analysis run on his existing towers or builds new structures. Those who are unwise likened themselves to the foolish man in the Bible who built his new house upon sand and when the storm came and the winds blew, it fell and great was the fall of it.

Many things have changed in tower fabrication, including construction methods and material, new technical engineering standards, insurance carrier requirements, and OSHA requirements.

By Charles Anderson, Vice President of Marketing, Western Towers

BACK TO BASICS

Tower structures are not items that immediately leap to mind when considering rebuilds or newbuilds. However, like many items that have been in the industry since its conception, towers used to be one of the first components of a cable system. In this month's Back to Basics, Charles Anderson, with Western Towers, takes a look at the antenna structure—the construction involved, engineering standards, and the future role of this industry equipment.

Construction methods and material

Early tower manufacturers had various ideas about the way to build a tower and what material to use to build it. Unfortunately for many, not all ideas worked nor were all materials equal. Presently, there are about 40 tower manufacturers in the United States. Each year, five or six companies go under, and twice that number begin in some garage. Only three companies have been in the tower business for more than 40 years, and possibly only one of these has never lost a tower due to structural failure within designed limits.

The earliest towers were fabricated from either angle iron or pipe. Both of these materials are still used today because of the relative low cost and availability, however the current swing is toward solid round material. This is true for several reasons, including higher compression strength, smaller surface area (reducing wind and ice loading), and no danger of rust out from the inside.

New technical engineering standards

The Electronic Industries Association (EIA) sets the standards for the tower structure industry and has established guidelines for tower design and fabrication under EIA RS-222 D. Any tower structure should meet these standards and should be sealed by a professional structural engineer. This weeds out fly-by-night manufacturers, prevents system outage due to tower collapse, satisfies requirement by insurance carriers and local building codes, and gives peace of mind to both the manufacturer and owner.

Insurance requirements

Insurance companies are becoming more concerned about losses coming from tower failures and liability claims stemming from injury or deaths caused by tower related accidents. Many claims by tower owners are being denied because the structure did not meet industry standards or fulfill OSHA requirements.

OSHA demands that all towers—with no exceptions—be equipped with a safety climb device. Most towers are not equipped with a safety climb, and no manufacturer provides this item except as an option. In a recent non-tower related accident, OSHA cited the tower owner and contractor for allowing the employee who was killed to climb a tower with an inoperative climbing device. The accident in question had nothing to do with climbing the tower and actually occurred on the ground 70 feet from the base of the tower. The lack of a safety climb may result in an extensive liability suit and possible insurance cancellation.

Conclusion

Antenna structures are high profile investments for cable operators and must be purchased wisely in a buyer beware market. The process of selection should include obtaining quotations from a select number of established manufacturers, analysis of fabrication methods and material, engineering back up and seal, and proven techniques of erection from experienced insured erectors. ■

Extended bandwidth makes debut at NCTA

Although it seemed to lack some of the "gee-whiz" announcements that made the last two National Cable Shows so memorable, this year's convention in Dallas clearly demonstrated that technology has finally caught up with some of the industry's forward-thinking engineers.

The convention floor was dominated by demonstrations of working fiber optic systems, expanded bandwidth amplifiers and off-premise addressable systems, among other things.

At least a dozen companies had AM fiber systems, and others (Texscan, Anixter and Synchronous Communications) were actually tied together via fiber. New generation lasers and R&D programs are beginning to pay off: some of the performance numbers quoted are getting extremely close to the minimum specs requested by American Television and Communications engineers, the architects of the now-famous "fiber backbone" concept.

Conspicuously absent were the usual massive HDTV demonstrations. Vendors like the David Sarnoff Research Center, Scientific-Atlanta, Magnavox, Zenith and others offered brief but relatively low-key looks at their technology, but clearly the focus of this show was how to get operational improvements today, not tomorrow.

Making its debut this year was extended bandwidth. Everywhere, from Jerrold and S-A to C-Cor, Magnavox and Texscan, there was talk of 750 MHz push-pull amps and discussions regarding the eventual availability of 1 GHz (1,000 MHz) electronics. All the above companies have postured themselves to be ready for the day when operators demand more bandwidth by offering redesigned housings when necessary and showing redesigned passive line equipment.

As has become custom in these pages, what follows is a company-by-company review of all the new products that were shown on the Dallas Convention Center floor. The companies are listed alphabetically.

Ad Systems

Ad Systems Inc. debuted it's new ABC-1000 automated break compiler that is designed to produce frame accurate, air-ready tapes for cable systems with commercial insertion equipment. According to a company representative, the ABC-1000 computer generates and records control and log tones along with the spot in a single pass and frame accurate edits are created via direct dubbing. The unit is priced at $19,995.

Ad Systems, (801) 263-1661.

AML Specialties

Introduced by AML Specialties Inc. was the Model MTSO10 low power microwave transmitter. The Model MTSO10, which operates at up to 250 milliwatts per channel, features an individual upconverter for each VHF input signal, low primary power consumption, a modular design and a linearized GasFet output amplifier (SSPA).

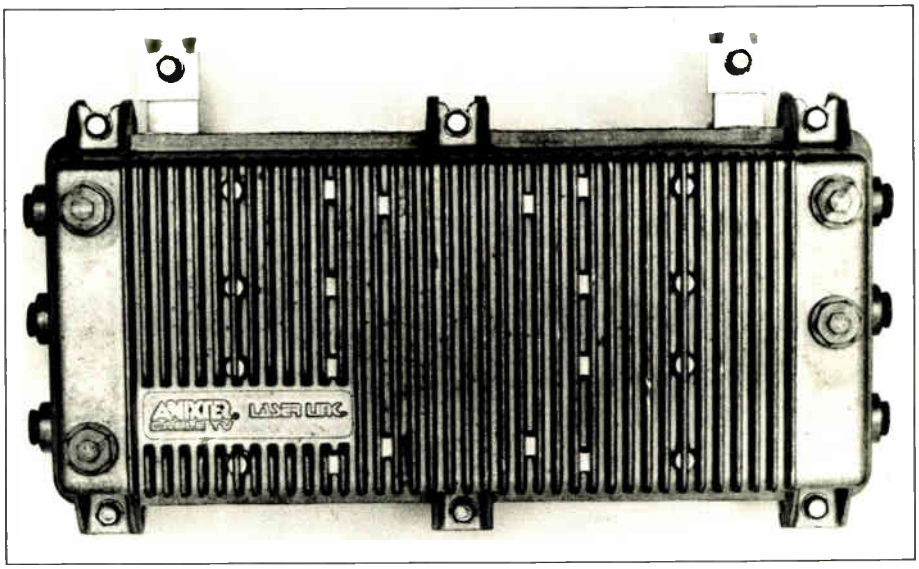
According to Bill Margiotta, CEO and director of engineering for AML Specialties, the Model MTSO10 has low cross modulation and minimal distortion. The VHF input signal can be modulated by VSB AM, FM or digital schemes.

AML Specialties, (619) 569-7425.

Anixter Cable TV

Anixter announced an agreement with Synchronous Communications where Anixter will be the exclusive marketing partner for all Synchronous products sold in the CATV industry for the next two years.

In addition, Anixter showed its new second-generation of Laser Link receivers, the LLR 2000, LLR 2100 and LLR 2200. All are available in a 1 GHz platform with optional plug-in modules to accommodate various architectures. The LLR 2000 is a basic node that converts a light signal to RF and provides a 20 dBmV output; the LLR 2100 combines a fiber receiver with 550 MHz feedforward technology; and the LLR 2200 is a full-featured receiver with an external splice enclosure.



Anixter's laser link

And finally, Anixter announced the sale of the 100th Laser Link system to Westmarc Communications.

Anixter Cable TV, (312) 677-2600.

Business Systems Inc.

BSI announced the development of The Wizard™ information system that is designed to provide operators with information about subscriber management, order entry, dispatching, market

support and analysis, outage analysis, addressability, pay-per-view control, receivables processing and inventory management.

Business Systems Inc., (803) 297-9290.

CableData

Several new hardware and software products were shown by CableData in Dallas, including DDP Software Release 8.0, TeleClerk 386 automatic response unit and additions to the PC Products Series.

The new software Release 8.0 involved the rewrite of more than 130 DDP programs and included three major enhancements: A new promotional rate code scheme allows cable systems to handle promotional pay service campaigns by automatically transferring the programming service to full price or another discounted rate at the end of the campaign; a job schedular allows managers to preschedule specific reporting jobs according to an assigned priority, eliminating the need for night-shift computer operators to monitor each job; and a new optional statement image feature gives CSRs a facsimile of statements so subscriber questions can be answered.

Also new is the TeleClerk 386 ARU. Based on the 32-bit Intel 80386 chip, TeleClerk's speed, throughput and expansion capability have been improved and can handle ANI, data integration and voice recognition applications.

Finally, the PC Products line has been expanded to include the PC-Tandem Link which allows an IBM or compatible PC to communicate with Tandem hardware; the PC Spreadsheet Interface, which allows operators to transfer data from CableData report files to spreadsheet programs; and DDP and QBS Emulators, which enables PCs to emulate DDP or QBS QuickScreen CRTs.

CableData, (916) 636-5800.

Cabletime

Cabletime is a British firm that initially intended to take Times Fiber's Mini Hub system and apply it in Europe, Instead, Cabletime developed a totally coaxial, two-way switched-star system purported to enhance signal security and interactivity.

At the heart of the system is the Cabletime switch, which includes a power supply, RF amp, digital and communication cards and switch cards for 16 subscribers (basic configuration).

Each switch card delivers one switched channel to the subscriber. However, in addition to the one switched channel, subscribers receive a block of up to 20 channels which are not switched.

Cabletime Limited, England (0635) 35222.

C-Cor Electronics

Three new products were unveiled at the National Show by C-Cor Electronics, including extended bandwidth products, a super trunk amplifier and a local area network (LAN) camera control system.

Designed as an interface device between fiber backbone systems and coaxial cable systems, the higher bandwidth products include backward-compatible trunk and line extender housings to accommodate 1 GHz electronics. The current extended bandwidth module allows operators to send 860 MHz down a system.

C-Cor's new Super Feedforward Trunk Station combines feedforward and power doubling technologies to provide improved composite triple beat and cross modulation over C-Cor's present feedforward equipment. This allows system operators to increase carrier-to-noise ratio or take advantage of improved CTB and cross-mod while maintaining present C/N numbers. The station can be used in either coax or hybrid fiber/coax systems.

Also, C-Cor's new LAN camera control system monitors up to 225 remote locations from a single point. Control software sequences up to 225 camera locations. Applications include area surveillance, highway traffic monitoring, access control or hazardous area monitoring, among others.

Finally, C-Cor announced the opening of a Denver location to serve the MSOs headquartered there. Dan Trayler, previously C-Cor's regional account executive for the Northwest Territory and Denver, will manage the office and becomes National Accounts Manager.

C-Cor Electronics, (814) 238-2461.

Channelmatic

Channelmatic displayed its new Adcart Channel Control Unit, CCU-202A, which is designed for random-pod-sequential users who want Adcart sophistication at a lower price.

CCU-202A will control one or two VCRs on one channel or one VCR on each of two channels simultaneously. It can also perform full random access on one channel using two VCRs to fill a one-minute avail. Features include full stereo audio, all-channel CRT status display, adjustable audio levels, full error reporting, direct spot-to-spot cueing and more. The CCU-202A is available now and is priced at $2,625 per channel.

Channelmatic, (619) 445-2691.

Comlux

Comlux announced the development of a new digital optical transmission system, which includes models 3561 and 3562.

The new units operate at 560 megabits/second and transport up to eight channels of uncompressed NTSC video and several channels of 20 kHz program audio and digital data on one fiber.

The transmitter consists of a high power laser diode and high-speed 4-to-1 time division multiplexer to accept four unphased 140 Mb/s digital inputs. The receiver contains a demultiplexer and an APD optical receiver. The system can transmit signals as far as 50 kilometers on single mode fiber.

Comlux, (415) 964-9628.

Hughes Communications

A joint venture formed by Home Box Office and Turner Broadcasting has finalized a contract with Hughes to purchase transponders on two successor satellites in Hughes' Galaxy fleet. The contract calls for purchase of transponders on Galaxy V, successor to Westar V, and Galaxy IR. They will be launched in 1991 and 1993 respectively.

International TeleSystems

CATV operators without addressability can now offer pay-per-view events with new technology developed by International TeleSystems Inc.

The TickeTV system is based on improved positive trap technology that makes non-addressable homes PPV capable for less than $20 per home and offers 7,000 distinct scrambling combinations.

International TeleSystems, (213) 274-7411.

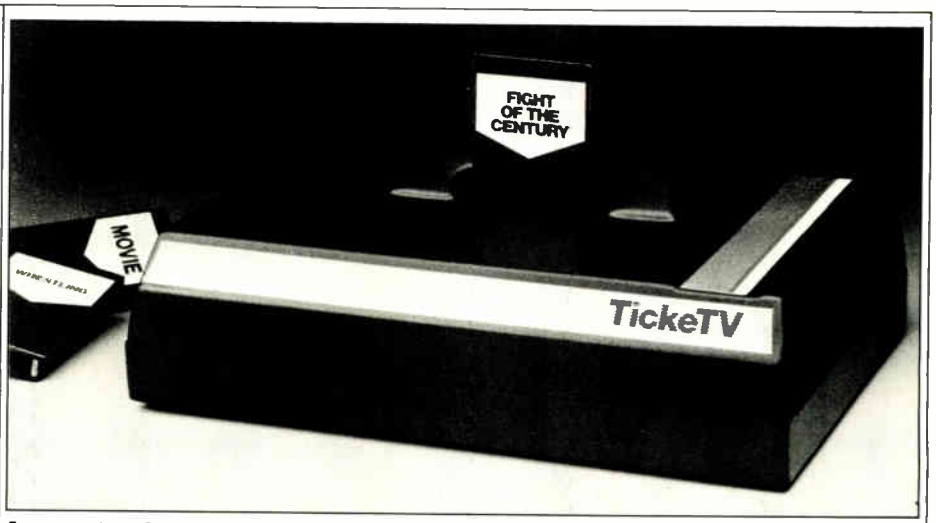
Jerrold

The Jerrold Division of General Instrument debuted two new converters, showcased its fiber products, introduced a new amplifier housing and announced a 1 GHz research and development program.

As noted in last month's issue of *CED*, a new addressable converter aimed at the international marketplace was shown. The Intercon 7000 set-top unit was designed to accommodate multiple video transmission schemes and different line voltages.

In addition, a new Tocom box was shown. The Tocom 5507 baseband addressable retains the features of the 5503-VIP and adds new, high-tech cosmetics and a green four-digit LED display. Features include remote volume control, unlimited barker channels, VCR timer and baseband video/audio outputs for direct connection to TV monitors and VCRs. It can also be upgraded to handle store-and-forward impulse ordering.

Also shown for the first time was the



International Tele Systems, Inc.'s TickeTV

new Starline SX amplifier housing. The unit is backward-compatible with both the SJ and X amp designs and has been designed to handle extended bandwidths that will become possible with the advent of fiber optics. The unit on the floor included a chassis and housing designed for 750 MHz operation in typical cable TV cascades.

But Jerrold isn't planning on stopping there. Aggressive cable operators who understand and are implementing fiber optics and HDTV are asking about 1 GHz electronics and Jerrold has announced an R&D project to develop the electronics. The company has already demonstrated a 1 GHz line extender platform derived from its Quadrapower LE.

Jerrold, (215) 674-4800.

Magnavox CATV Systems

Not to be outdone, Magnavox had plenty going on in its booth, too. From a new AM fiber system to a demonstration of HDTV, to a redesigned amplifier housing and electronics, Magnavox had it all.

The new "Magnahub" AM system is essentially the same system offered by other vendors; it utilizes multiple laser diodes to provide VSB-AM signals out of the transmitter and the receiver integrates fiber with RF technology. The receiver converts light to RF by routing the signals through upgradeable splice organizer and connector panel, then inputting the signals into a maximum of four receivers (or three receivers and one return transmitter).

After the conversion to RF takes place, AGC is added and status indication is detected. After being recombined, the signals may pass through an optional A/B switch before entering the trunk/bridger amps. Magnavox was quoting the following specs for Magnahub: 55 dB C/N, -65 dB CTB and -63 dB CSO for 20 channel loading and 5 dB loss. The unit will be in production by December.

Also, Magnavox mainstation and line extender housings have been redesigned to provide better heat dissipation, which effectively doubles the life of the amplifier. The Series 2000 amps feature diagonal convective fins for both horizontal and vertical applications.

Also, optional right-angle ports provide installation flexibility and help eliminate 90-degree and 180-degree connections. Also optional are new 1-inch trunk ports. This new series of housings is now in production.

Also in production are 860-MHz push-pull amplifiers, which the company had in display in its booth. Utilizing currently available hybrids, the new amps can accommodate up to 120 channels.

Magnavox, (315) 682-9105.

Midwest CATV

Two product announcements and news related to Midwest's growth were made at the Show.

The company announced it has become the only stocking distributor of Jerrold fiber optic products, including the new S product group; also, Midwest is now carrying the Millenium line of multitaps and passive devices. Engineered and manufactured by Antronix, the multitap passes 750 MHz with a housing built to pass 1 GHz and features the Cam-Port. A two-way splitter is also part of the product group.

Midwest also announced the completion of its expansion plans by opening a warehouse in Phoenix. It is located at 616 S. 55th Ave., (602) 233-3555.

Midwest CATV, (304) 343-8874.

Nexus Engineering

Nexus introduced its third generation of headend products—the Series 100. The modular design, with multiple channel configurations, allows cable operators to reduce the required amount of headend space. Twelve VideoCipher® scrambled satellite channels, two unscrambled satellite channels and seven off-air channels are capable of fitting into 49 inches of rack space. The line includes multichannel satellite receivers, multichannel television modulators and the VideoCipher® Mainframe Board (VCMB).

Nexus also demonstrated its new NX-100 Headend, designed for headends that target smaller communities. The NX-100 headend is based on Nexus' Series 100 product line. It features the VCMB, the SR-100 multichannel satellite receiver, the VM-100 multichannel television modulator and the TD-5 television demodulator.

Nexus Engineering, (604) 420-5322.

Orchard Communications

The first prototype models of Orchard's new IF/FM fiber optic system were shown in Dallas. The system boasts transparency to scrambling and is said to eliminate the need to convert to baseband at the FM/AM interface.

The system's modulator converts the standard 45.75 MHz IF output of a VSB-AM modulator to an output suitable for transmission over a broadband fiber system. At the receive end, the 45.75 MHz IF output of the demodulator is up-converted for direct feed to coax cable.

The new system is expected to handle at least 12 channels per fiber and can transmit those signals up to 20 miles without repeaters.

Also shown was MM-Net, a switched fiber network designed for video conferencing and the sale of interactive video services by CATV operators, telcos and utilities.

Orchard also announced the designation of Toner Cable Equipment Inc. as the CATV industry distributor for Orchard's fiber optic electronic products.

Orchard Comm., (203) 284-1680.

Ortel Corp.

Ortel Corp. introduced the 2605A, a new broadband photodiode receiver for CATV applications. The receiver uses a unique broadband RF output circuit to maximize delivered power and achieve 10 dB higher RF gain than an unmatched photodiode, all with negligible distortion.

According to Larry Stark, Ortel's director of marketing, the 2605A receiver can run at high optical power without the distortion that normally accompanies transimpedence amps. The receiver's features include 10 MHz to 550 MHz response, 10 Db gain over standard photodiodes, compatibility with 75-ohm CATV amplifiers and high responsivity.

Pioneer

Pioneer Communications of America announced the availability of the LC-V330 LaserDisc™ Autochanger System. The autochanger allows a cable operator to design and customize a pay-per-view (PPV) channel according to individual demographic factors. Video Jukebox Network Inc., an interactive television network, will be the first American user of the product.

The LC-V330 is a fourth generation autochanger designed specifically for U.S. applications. It has a capacity of 72 video discs with a program capacity of two hours each. The Jukebox Network will be able to store as many as 2,000 separate music videos in each Jukebox unit in the field. The laser videodisc uses a non-contact optical

pickup, delivers over 400 lines of horizontal resolution for improved picture clarity and provides for quick random access within and between discs.

Also new from Pioneer is a PC addressable control system designed for small- to mid-sized cable systems. Two addressable configurations are possible: the M2A functions as a stand-alone system while the M2A can interface with a billing system. The new controller allows cable operators to pre-schedule up to 256 pay-per-view events. The M2A can support up to 32,000 subscriber records while the M2B can support 50,000 records.

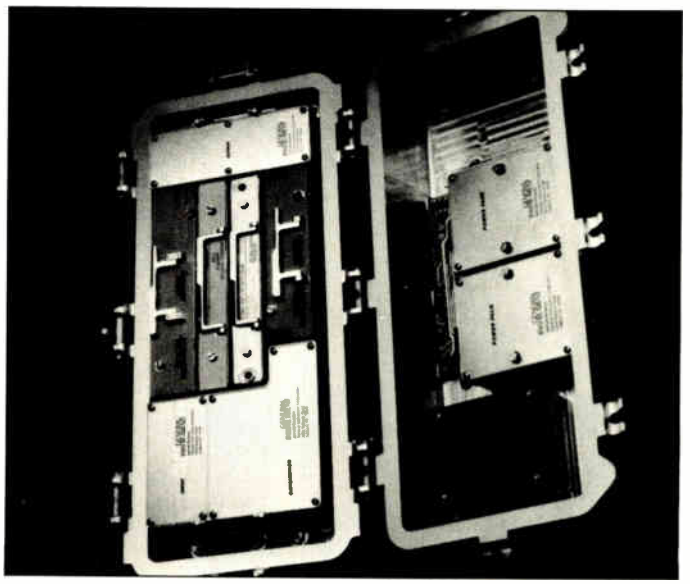
Pioneer Comm., (201) 327-6400.

Sarnoff Research Center

Announced at the show by the David Sarnoff Research Center was the successful satellite transmission of ACTV I, an encoded advanced television broadcast signal that is NTSC-compatible. Scientists at the Sarnoff Center, a subsidiary of SRI International, transmitted the ACTV I signal 44,000 miles roundtrip to and from a 40 watt Ku-band transponder on May 9, 1989. The transmission did not require additional satellite hardware to send or receive the ACTV I signal.

Also announced by the Sarnoff Center was a new, wide screen, enhanced definition television production system called the "Studio of Tommorrow." The production system uses studio and production equipment available today with modified cameras and video tape recorders to produce the wider, enhanced definition images.

David Sarnoff, (609) 734-2507.



Jerrold's Starline SX Amplifierr

Scientific-Atlanta

Scientific-Atlanta displayed its addressable off-premises system (which will soon be field tested in a Warner system) and new headend and distribution gear that passes up to 870 MHz. The technology demonstration of the 870 MHz amplifier was shown in a standard S-A housing, which is usable up to 1 GHz. Also shown was S-A's 750 MHz versions of fixed channel and frequency agile modulators and processors.

In fiber news, S-A announced it won the contract to supply Jones Interca-

ble's fiber rebuild in Turnersville, N.J. The contract calls for 18 AM transmitters (Model 6450) and 18 AM bridging amps (Model 6901).

Finally, S-A also exhibited its HDTV product, HDB-MAC, using a high resolution video projection system displaying a 16-by-9 aspect ratio image. HDB-MAC incorporates a spectrum-folding technique to achieve 950 horizontal lines of resolution with a 525-line progressive scan and a vertical resolution of 480 lines per picture height. HDB-MAC is a product extension of Scientific-Atlanta's B-MAC transmission system.

Scientific-Atlanta, (404) 441-4000.

SecaGraphics

Announced by SecaGraphics was an upgrade to their engineering and drafting package—Magic. The new software, the Outage and Vehicle Location (OVL) System, features realtime graphics display and status of cable system geography, system maps, troublecall and outage locations, route and plant as traced to the headend, installation/disconnect locations and vehicle locations.

SecaGraphics, (303) 279-7322.

Standard Communications

Introduced by Standard Communications Corp. is the new CSG60 BTSC Stereo Generator, a BTSC stereo encoder system designed to provide MTS stereo within existing CATV systems. The unit incorporates a modular design format which permits the installation of two CSG60 stereo modules in a 1.75-inch high rack space. The CSG60 uses dbx companding, a video sync lock and a 4.5 MHz modulated RF output for right/left stereo separation and maximum signal-to-noise ratios.

Standard also announced the availability of the CRC810, a remote control computer interface for the Agile Omni PRO satellite receiver. The interface provides an RS232C port that is capable of operation at 300, 1200, 2400 and 4800 baud rates. The CRC810 incorporates an IBM-based software package which controls up to eight functions including transponder center frequencies (in 100 kHz steps), multiple antennas, video and antenna polarity, six I.F. bandwidths and audio subcarrier frequencies (in 5 kHz steps) with three bandwidths; and switching between C-and Ku-bands, scan and various on-off cycles. The CRC810 permits operators to control satellite receivers from a remote geographical location.

An optional integrated receiver descrambler, the Agile IRD, was also demonstrated by Standard. The unit was designed as an optional upgrade for the Agile 40C/K and Agile 32C/K receivers and will integrate the VideoCipher® module with existing Standard receivers without modification of the chassis design. According to Mason Truluck, SatCom division director, operators should feel at ease with the Agile IRD system because of its front panel similarities with existing VideoCipher® IIC units.

Standard also named Toner Cable Equipment as the CATV distributor for its Satcom Division products. Toner will distribute Standard's complete product line, including C- and Ku-band receivers, agile receivers, LNA and LNB low noise amplifiers, down converters and BTSC stereo generators.

Standard Comm., (213) 532-5300.

Sumitomo Electric

Attending its first NCTA Show was Sumitomo Electric, a fiber optics firm well-known overseas but just making itself known in the CATV industry here. It showed its loose tube fiber cable, digital and AM electronics and fusion splicer.

The Suminet 5840 transmits 40 channels of video over a single fiber 10 to 15 kilometers and is offered in rack-mount, strand-mount and pole-mount versions. A typical performance spec over 12 km of fiber would be 52 dB C/N with 6.1 dB path loss.

Also, the new Type 35 fusion splicer is designed for field use and features 16 different programs for different fiber types. It features a built-in video monitor with status display, a top-mounted, menu-driven control panel and automatic estimation of splice loss and external appearance.

Sumitomo Electric, (919) 541-8273.

Telecorp Systems

Telecorp Systems Inc. introduced a voice recognition module for audio response applications. Designed for use with Telecorp's System 6000, the module will allow cable subscribers with rotary telephones to enjoy the same benefits of audio response unit (ARU) technology as touch-tone® callers.

Telecorp also announced the expansion of the System 6000 ARU with three separate models which feature up to 20, 32 and 60 ports, respectively. Large-capacity units will allow cable systems with a large number of telephone lines to use one ARU for all telephone traffic instead of linking small systems together.

Also demonstrated at the show was the System 6000 software release 3.0 for the cable industry. The release adds automatic outage reporting and notification, and voice messaging capabilities to the System 6000.

Trilithic

New from Trilithic is the Model 7RSABM RF switch bank designed for remote switching in headends and hubs. The unit consists of a mainframe/power supply, an addressable control card and up to 16 individually addressable A/B switch cards in a common bus.

Applications include drop signal switching, video source changes (related to the upcoming syndicated exclusivity rules), test instrumentation path routing or other automated switching needs.

Trilithic, (317) 545-41996.

Video Data Systems

New from Video Data Systems is the Laser Cine-Machine, a computerized pay-per-view movie and promo playback system. The system uses optical laser video discs, offers compact disc-quality audio and 420 lines of horizontal resolution.

The system is being offered on a service bureau basis to keep costs down. Operators select a minimum of 10 titles 30 days in advance and the following month's schedule and on-air promotion are developed and sent back via modem.

Video Data Systems, (516) 231-4400.

Zenith Electronics

Zenith unveiled its new "Command Series" of addressable controllers. The new family of PC-based systems controls both baseband and RF decoders and consists of two distinct products: Management Activated Pay-Per-View (MAPPV) and Phonevision. Each is available for both Z-Tac and PM systems using a Zenith PC controller.

The MAPPV system is designed for one-way systems where management fills orders and features data back-up, program authorization data trail, multiple security levels, fast throughput and the ability to process 10 orders per second. Phonevision offers those features and can receive PPV orders via ANI. Phonevision can process up to 100 orders per second.

Zenith Electronics, (312) 391-7000. ■

—Roger Brown and Kathy Berlin

High tech tapped trunk

The following article has been derived from numerous local SCTE Chapter meetings.

Build 12 house passings per mile and make money! A field proven method to deliver 40 channels a distance of ten miles or further with substantial cost savings per mile. The final customer, 10 miles deep, will have a 50 dB carrier-to-noise at the tap, -52 dB composite triple beat (C.W. carriers), and -51 dB synchronous cross modulation. If 40 channels are not enough, the system can be upgraded to 52 or 60 channels without re-spacing.

In the past "tapped trunk" has earned a reputation as being an inexpensive, unreliable method to build CATV plant that results in "noisy" pictures when cascaded. Usually, when a operator resorted to tapped trunk, the resulting design cut every cost corner and often become obsolete within two to three years.

Several years ago my friend Bill Simmons, at that time, vice president of engineering for Mickelson Media, commented on the remaining CATV cable plants that could be built. Bill said, "The cake is gone and now we (the cable operators) are fighting over the crumbs," He was right, most passings that remained were less than 25 homes per mile and often were located near existing CATV systems. A method was needed to reliably deliver high quality pictures for lower cost per mile.

By Fred Rogers, President, Quality RF Services, Inc.

Achieving high tech tapped trunk

- Use strand and lashing wire to install the single 0.500 inch cable required. Use conventional CATV design for areas exceeding 20 houses per linear mile. Tapped trunk can be used feeding from existing trunk runs (not from a bridger port) as long as proper distortion parameters are maintained.
- In sections with long distances and very few homes, underground will often be cost effective by reducing pole rental fees.
- All hard line connectors must be integral sleeve and covered with heat shrink.
- All passives should be 450 MHz or higher frequency. The taps selected must carry at least 6 amperes current. All unused tap ports should be terminated for best system broadband flatness of response. Locking terminators add security to the system, but regular 76 ohm terminators are fine.
- The active electronics will be the key. The following power doubling specifications will fill the need:

Noise figure including equalizer: 7 dB mini trunk; 8.3 dB dual pilot trunk.

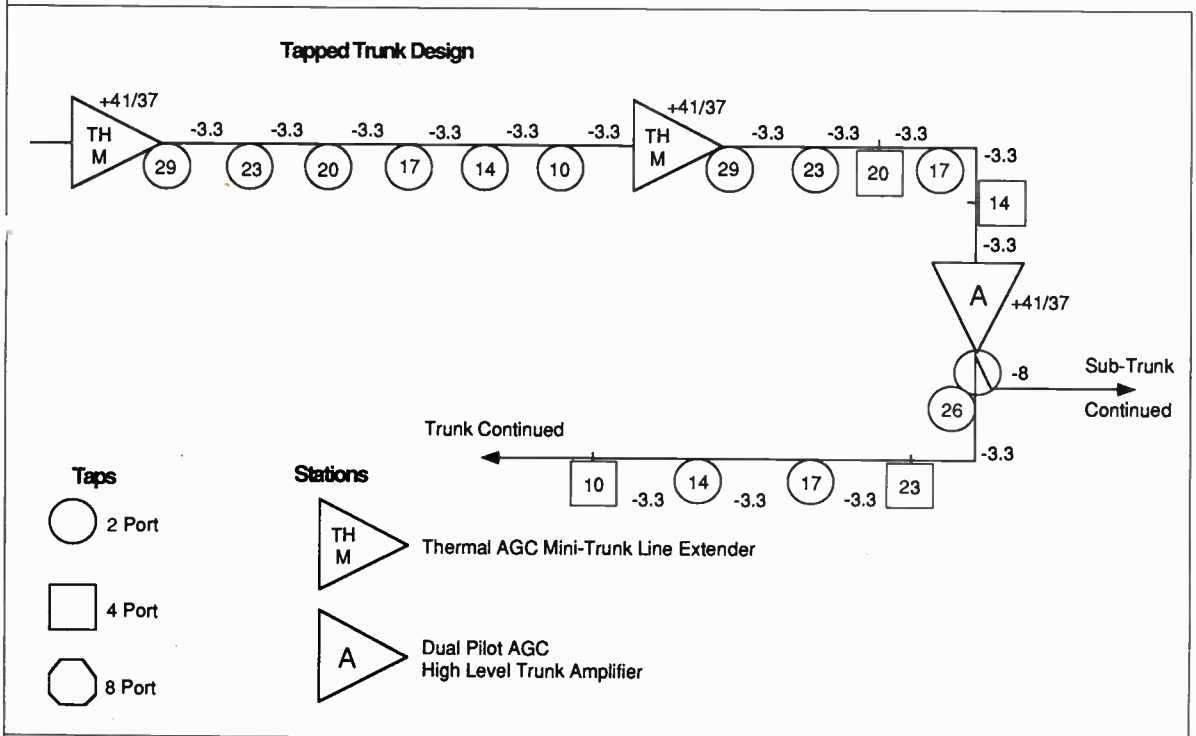
Input Level: 15/15 dBmV mini trunk; 17/17 dBmV dual pilot trunk.

Output Level: 41/37 dBmV mini trunk -83 dB C.T.B.; 41/37 dBmV dual pilot trunk -81 dB C.T.B.; 41/37 dBmV mini trunk -82 dB cross modulation; 41/37 dBmV dual pilot trunk -80 dB cross modulation; 41/37 dBmV mini trunk -77 dB 2nd order; 41/37 dBmV dual pilot trunk -77 dB 2nd order.

Input levels should be equalized and padded properly to achieve the desired 15 dBmV or 17 dBmV within one dB (allowing for the average temperature of the area). Plug in pads in one dB steps must be available. Dual pilot amplifiers must operate properly with either 41/37 dBmV or any other level selected. The use of power packs that contain excellent surge protection is highly recommended. Each mini trunk should contain either an 11 dB or a 20 dB plug-in thermal compensation network. These amplifiers are not line extenders, but trunk modules contained in line extenders housings.

All amplifier modules used will be power doublers with higher than normal gain (31 dB module gain) and these modules must have a high tolerance for surge overvoltages.

- Aerial drops should be messenger type RG-6 with 67 percent or higher



shielding. Underground drops should be "flooded". Typical cost for electronics should be $1,000 to $1,400 per mile. Cost reductions would be possible using refurbished housing.

- High quality "F" connectors, and heatshrink or rubber boots will be required for all drops.
- Tap levels should be designed for a minimum of 12 dBmV at channel 41 and two port taps used in most cases.
- Only 60 volt AC powering should be considered.

Summary

Ironically, "high tech tapped trunk" can be used by the nearest existing cable operator to cost effectively cover areas containing a minimum average of 12 homes passings per linear mile or by another cable operator attempting to get a foothold in the area. Either way "high tech tapped trunk" has proven to date to be a highly reliable, cost effective method to build low density areas. If existing operators ignore cost effective methods to serve local low density areas, very likely some other CATV operator will be more than willing to show them how it is done. ■

CATV system distortions

System Name....High Tech Tapped Trunk **Date...6-12-89**

	Amp #1			Amp #2		Amp #3	Amp #4	Amp #5	Total
Noise Figure	1	+8.3	19	+7.0	37	55	73		
CTB Output Cap	2	+42.0	20	+42.0	38	56	74		
CTB Rating (-dBmV)	3	-79.0	21	-81.0	39	57	75		
XMOD Output Cap	4	+42.0	22	+42.0	40	58	76		
XMOD Rating (-dBmV)	5	-78.0	23	-80.0	41	59	77		
2nd Output Cap	6	+42.0	24	+42.0	42	60	78		
CSO (-dBmV)	7	-77.0	25	-77.0	43	61	79		
HUM	8		26		44	62	80		
Channel Capacity	9	+40.0	27	+40.0	45	63	81		
Carrier/Noise	10	-56.4	28	-52.9	46	64	82		-51.3
Crossmod	11	-59.2	29	-55.6	47	65	83		-51.2
CTB	12	-60.2	30	-56.6	48	66	84		-52.2
CSO	13	-63.4	31	-59.2	49	67	85		-57.8
Channel Loading	14	+40.0	32	+40.0	50	68	86		
Amplifier Input		+16.0		+14.0					
Gain	15	+25.0	33	+27.0	51	69	87		
Bridger DC Loss	16		34	+0.0	52	70	88		
Cascade Length	17	+11.0	35	+21.0	53	71	89		
Amplifier Output	18	+41.0	36	+41.0	54	72	90		

Cumulative System Distortions:

Carrier-to-noise ratio	51.3 dB
Composite triple beat	-52.2 dBc
Cross modulation	-51.2 dBc
Second order distortion	-57.8 dBc

Table 1

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Call toll free 1-800/433-2160; In Texas call collect 817/599-7623.

MICROWAVE FIELD ENGINEER—Rural NE, Hughes & Collins High Power. $30K
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CONSTRUCTION COORDINATOR—West. Accounting knowledge. $35K
DIRECTOR OF ENGINEERING—50K subs in MW, $40K
PLANT MANAGER—So. Cal., $35K
SYSTEM ENGINEER—Rocky Mountains, 60K subs, $40K
PLANT MANAGER—SE, 5+ years cable exp. $30K
CORPORATE ENGINEER—SE, $35K
FIBER OPTICS ENGINEER—MW, Manufacturer Applications, to $60K
DIRECTOR OF ENGINEERING—40K subs, extensive microwave configuration, $42K
HEADEND ENGINEER—Coastal SE, $35K
REGIONAL ENGINEER—East, Strong Admin skills, $50K
PLANT MANAGER—NE, Construction exp. $25K
PLANT MANAGER—NE, $34K
REGIONAL ENGINEER—SE, top ten MSO, $50K
CHIEF ENGINEER—25K subs, Canada, $35K
TECHNICAL MANAGER—Addressability a must. $35K
TECHNICAL MANAGER—North, $35K
CHIEF TECHNICIANS—Opportunities nationwide from S. Cal to ME & FL from $25-35K
LINE TECHNICIANS—All over US. Companies will relocate! From $10-14/hr.

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P.O. Box 5300, Norman, OK 73070
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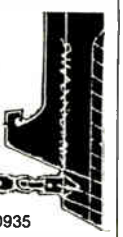

1-800-383-PLOW
(719) 475-PLOW P.O. Box 17701
Colorado Springs, CO 80935

CATV EQUIPMENT SALES

Channell Commercial Canada Ltd., a leader in the development and manufacture of underground construction materials for the CATV industry, is expanding its sales staff in Canada.

We are seeking a qualified sales representative with a minimum of three years experience in cable television construction and/or engineering.

If you have the background, skills and desire to represent an outstanding product line, we offer a competitive compensation package and opportunity to grow professionally.

For confidential consideration, please send resume and salary history to Ms. Lynda Forsyth, Operations Administrator, Channell Commercial Canada, Ltd., 6341 Mississauga Road, Mississauga, Ontario L5N 1A5.

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BUSINESS DIRECTORY

CLASSIFIEDS

Ad Index

SCTE

July 8-10 *Big Sky Meeting Group* will hold a technical seminar on "Headends" with Richard Covell of General Instrument/Jerrold Division. The July 8 seminar will be held at the Grouse Mountain Resort in Whitefish, Mont. and the July 10 seminar will be at the Harlowtown Youth Center, Harlowton, Mont. For details call Marla DeShaw, (406) 632-4300.

July 11 *Central Illinois Chapter* will host "Technical Management Seminar," an appreciation party for all chapter and ICTA members for their support. Call Tony Lasher, (217) 784-5518 for info.

July 11 *Chattahoochee Chapter* will present a technical seminar on "Basic Troubleshooting," in Statesboro, Ga. Call Jack Connolly, (912) 741-5068 for details.

July 11-12 *Florida Chapter* will conduct a technical seminar. The Central Florida Group will be at the Holiday Inn North, Lakeland, Fla. on July 11 and the Gulf Coast Group will be on 12 July. Call Denise Turner, (813) 626-7115 for info on either seminar.

July 12 *Dairyland Meeting Group* will hold a technical seminar on "Signal Security and Theft." For info on location call Bruce Waleske, (715) 842-3910.

July 12-13 *Upstate New York Meeting Group* will hold two technical seminars: July 12 in Buffalo, N.Y. and July 13 in Auburn, N.Y. For more details call Ed Pickett, (716) 325-1111.

July 13 *Central California Meeting Group* will host a technical seminar. Call Andrew Valles, (209) 453-7791 for more info.

July 14 *Mount Rainier Meeting Group* will sponsor a technical seminar on "Data." Call Sally Kinsman, (206) 867-1433 for details.

July 15 *Cactus Chapter* will sponsor a technical seminar. For info on topic and location call Harold Mackey, Jr., (602) 866-0072, ext. 282.

July 15 *Chaparral Meeting Group* will hold a technical seminar. Call Bob Baker, (505) 763-4411 for info.

July 19 *Razorback Chapter* will hold a technical seminar at the Days Inn, Little Rock, Ark. For details call Jim Dickerson, (501) 777-4684.

July 19 *Dairyland Meeting Group* will host a technical seminar on "Signal Security and Theft," at the West Bend Royale Hotel, West Bend, Wis. For more info call Jeff Spence, (414) 738-3180.

July 19 *Great Plains Meeting Group* will hold a technical seminar on "Headend Maintenance, Satellite Technology and Off-Air Signals. For info on location call Jennifer Hays, (402) 333-6484.

July 20 *Golden Gate Chapter* will hold a technical seminar at the Italian Gardens, San Jose, Calif., on "Fiber Optics." Speakers include Sanford Lyons with Siecor Corp., Vince Borelli with Synchronous Communications, Larry Nelson with Comscope Corp. and J.R. Anderson with Anixter. For details call John Parker, (408) 437-7600.

C-COR® ELECTRONICS INC

C-COR Electronics "state of the art" seminars are three-day events designed to instruct relatively new technicians in basic theory, installation and maintenance of cable TV systems. Attendance is limited to a maximum of three persons from one system. The fee is $195.

Sept. 19-21 *C-COR Electronics Seminar* will be held in Dallas, Texas. Call Teresa Harshbarger, (800) 233-2267, ext. 326 to register or for details.

Oct. 17-19 *C-COR Electronics Seminar* will be held in Boston, Mass. Call Teresa Harshbarger, (800) 233-2267, ext. 326 to register or for additional info.

MAGNAVOX

The Magnavox CATV Systems mobile training center is a fully-equipped laboratory on wheels for cable training. The three-day seminars combine instruction in theory and practical hands-on training, using gear and test equipment common throughout the industry. The fee is $300.

Sept. 12-14 *Magnavox Mobile Training* will be held in Columbus, Ohio. Call Amy Costello Haube, (800) 448-5171 (in NY state, (800) 522-7464) to register, or for additional info.

Sept. 18-20 *Magnavox Mobile Training* will be held in Detroit, Mich. Call Amy Costello Haube, (800) 522-7464) to register, or for additional info.

Sept. 25-27 *Magnavox Mobile Training* will be held in Indianapolis, Ind. Call Amy Costello Haube, (800) 522-7464) to register, or for additional info.

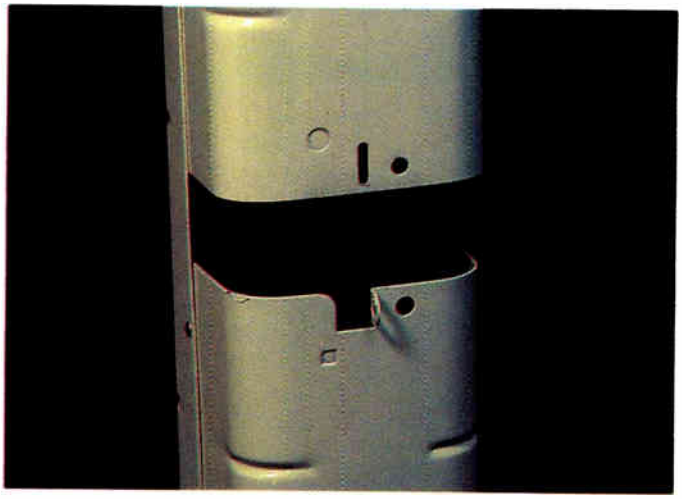
Et cetera

July 17-19 *The New England Cable Television Association*'s annual convention and exhibition will be held in Newport, Rhode Island. For more info call William Durand, (617) 843-3418.

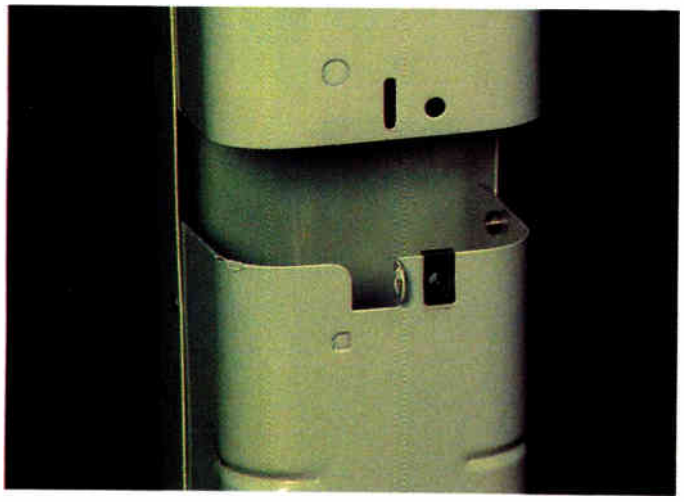
July 18-20 *The Florida Cable Television Association* will hold it's annual convention at the Registry resort in Naples, Fla. Call Joice Ventry, (904) 681-1990 for details.

FAST FIELD SECURITY FOR YOUR CABLE TV PEDESTAL

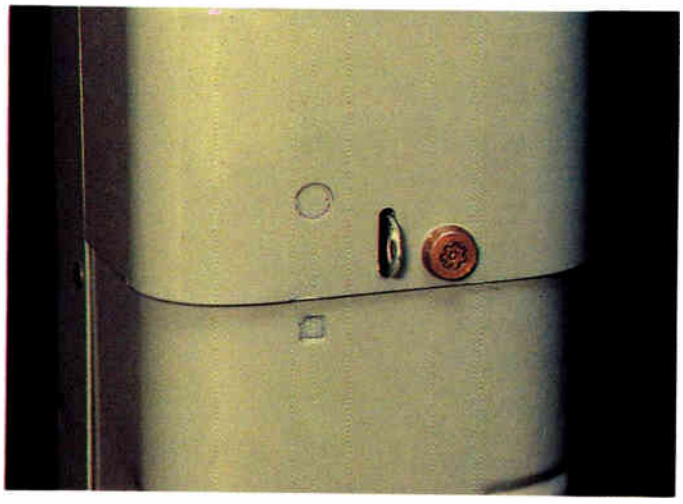
Pedestal cover with knock out in place.



Knock out is easily removed with hammer and ordinary screwdriver.



Locking clip fits over pedestal in seconds.



Star Lock is tightened and removed only with special screwdriver type key for maximum security.

Only Reliable pedestals come with factory-provided knock outs for installing **Diversified Control Systems** Star Locks.

A small but important feature... because it provides maximum security for cable TV pedestals or apartment boxes fast and easy right in the field.

Hasp broken or missing? No problem. Diversified's Star Locks are designed to deliver a secure closure without using the hasp.

It's a great combination: Star Locks and Reliable Electric, the best-selling pedestals in the industry. And you can get them both from one trusted source: Anixter Cable TV.

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In an emergency, weekends and holidays or after 5 P.M. call toll free 1 (800) 323-8166.

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