Inside: Orbital Arc Wall Chart

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THE PREMIER MAGAZINE OF BROADBAND COMMUNICATIONS

MAY 1994

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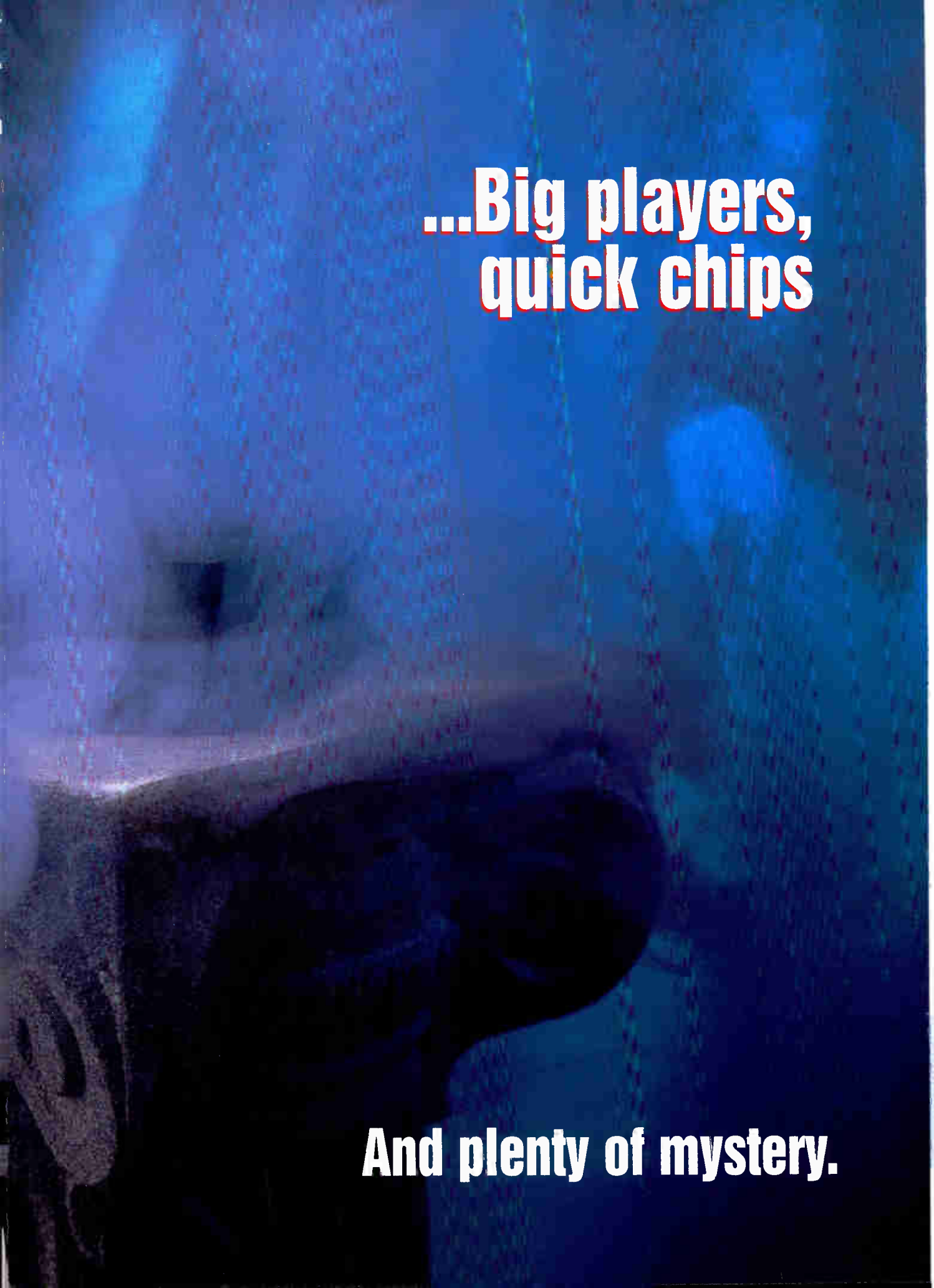
Construction forecast ◆ Convergence ◆ NCTA / SuperComm issue

Brewing the set-top of the future...

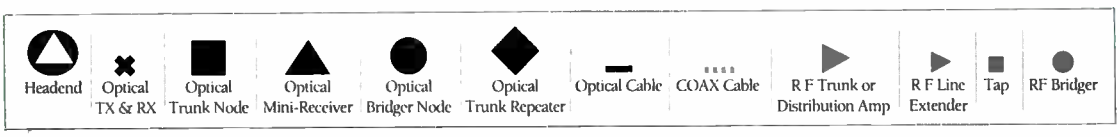

...Big players,
quick chips
And plenty of mystery.

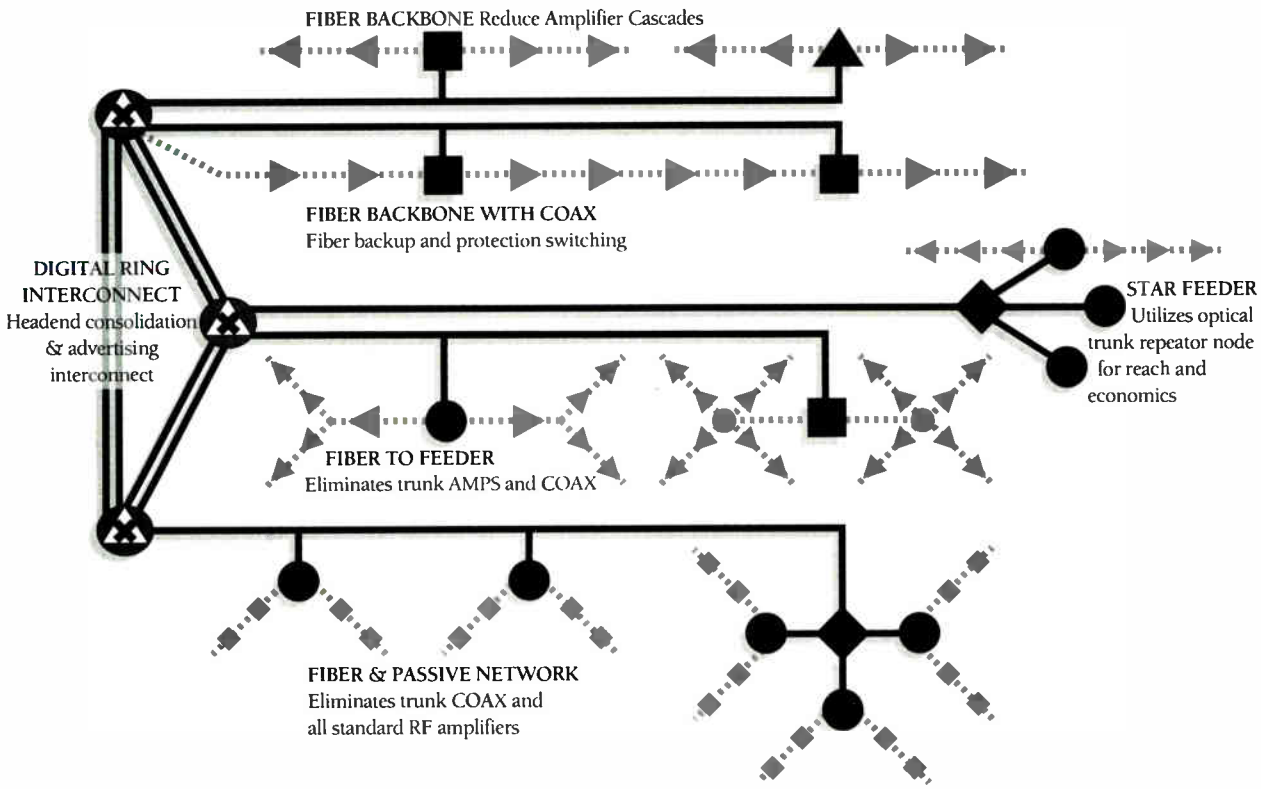
At what point do

Motorola
Digital Equipment
Kaleida Labs
Oracle
Silicon Graphics
3DO
and
SEGA Channel

Converge?

Everything You Need For Video Fiber Optics From One Manufacturer





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"Total solutions" approach important for MSOs, LECs

The landscape is changing

By Kent Takeda, Director of Marketing, AT&T Network Systems

The lightning speed of change in the communications industry is nothing short of phenomenal. Although there remains to be competition in the loop, the lines between MSOs, LECs, CAPs and cellular providers are quickly blurring as consumers learn more about–and demand–new interactive services. Many people in our industry suggest that this period will be the most exciting in the history of American business.

Hyperbole? Probably not. There are good reasons for all the new mergers and acquisitions we've seen in the last 18 months. Although the media's enthusiasm may create heightened expectations, the anticipated demand for new services and the development of new technology is combining to speed the creation of integrated cable/phone platforms for digital video and telecommunications applications.

New energy

The convergence of broadband technology among MSOs and LECs has energized both industries. There is a great deal of effort behind developing the protocols and equipment necessary to support a vast array of digital media and telecommunications services delivered over hybrid networks. And for good reason.

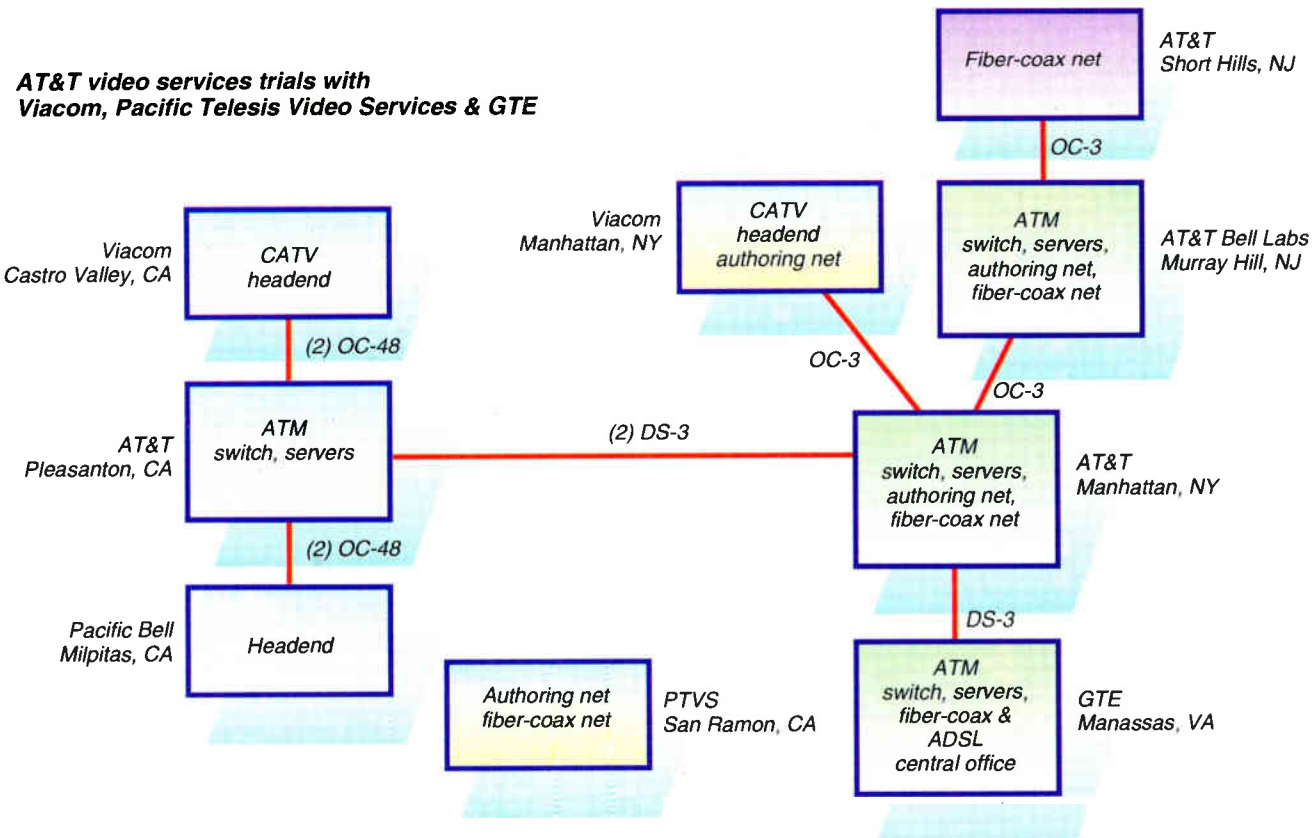
The market size for video network equipment and services among MSOs and LECs will grow from $8 billion today to $25 billion by the year 2001. Likewise, consumer video spending will grow to $67.5 billion in two years and to $93.25 billion by the end of the century.

These kind of growth projections demand attention from network and service providers, as well as network planners. As spending increases on both sides of the equation, the communications environment in the U.S. is moving toward services requiring two-way, switched, broadband networks.

Both cable and telco are forging ahead rapidly with network improvements. Major cable MSOs have indicated that up to 90 percent of their plants in 48 states will be two-way interactive by the end of 1996. At least one telco, Pacific Bell, will begin digging trenches this month to lay a multi-billion dollar hybrid network in California.

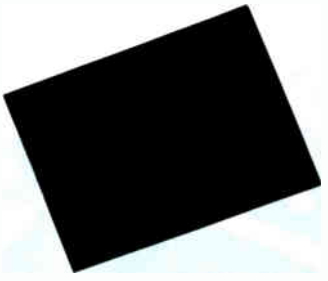
This trend suggests challenges and opportunities for both MSOs and LECs. For LECs, the fiber/coax star/bus array offers an integrated network system capable of handling both analog and digital signals for less than $1,000 per household (compared to roughly $1,300 per line for traditional copper networks.)

Moreover, hybrid networks for telcos have the capability to significantly reduce operating costs for service provisioning and assurance.



While Others Talked About Accessing The Information Superhighway,

ADC Designed And Built The First Onramp.



Get The Show On The Road With ADC's Homeworx Access Platform.

With evolving digital technology and emerging broadband markets, service providers need networks that can support current telephony and video services... and still be able to migrate to the advanced broadband world of tomorrow. Should you earn revenues today or invest in tomorrow? With the Homeworx access platform and its advanced hybrid fiber/coax (HFC) architecture, you can do both.

Pioneered by ADC, HFC architecture supports today's services such as basic cable television and standard telephony while offering a simple and direct migration path to future broadband services. Best of all, HFC delivers the lowest cost, most flexible solution for telephony and video transport.

For more information on how the Homeworx platform can put you in the driver's seat, call us at **1 800 366-3891**.

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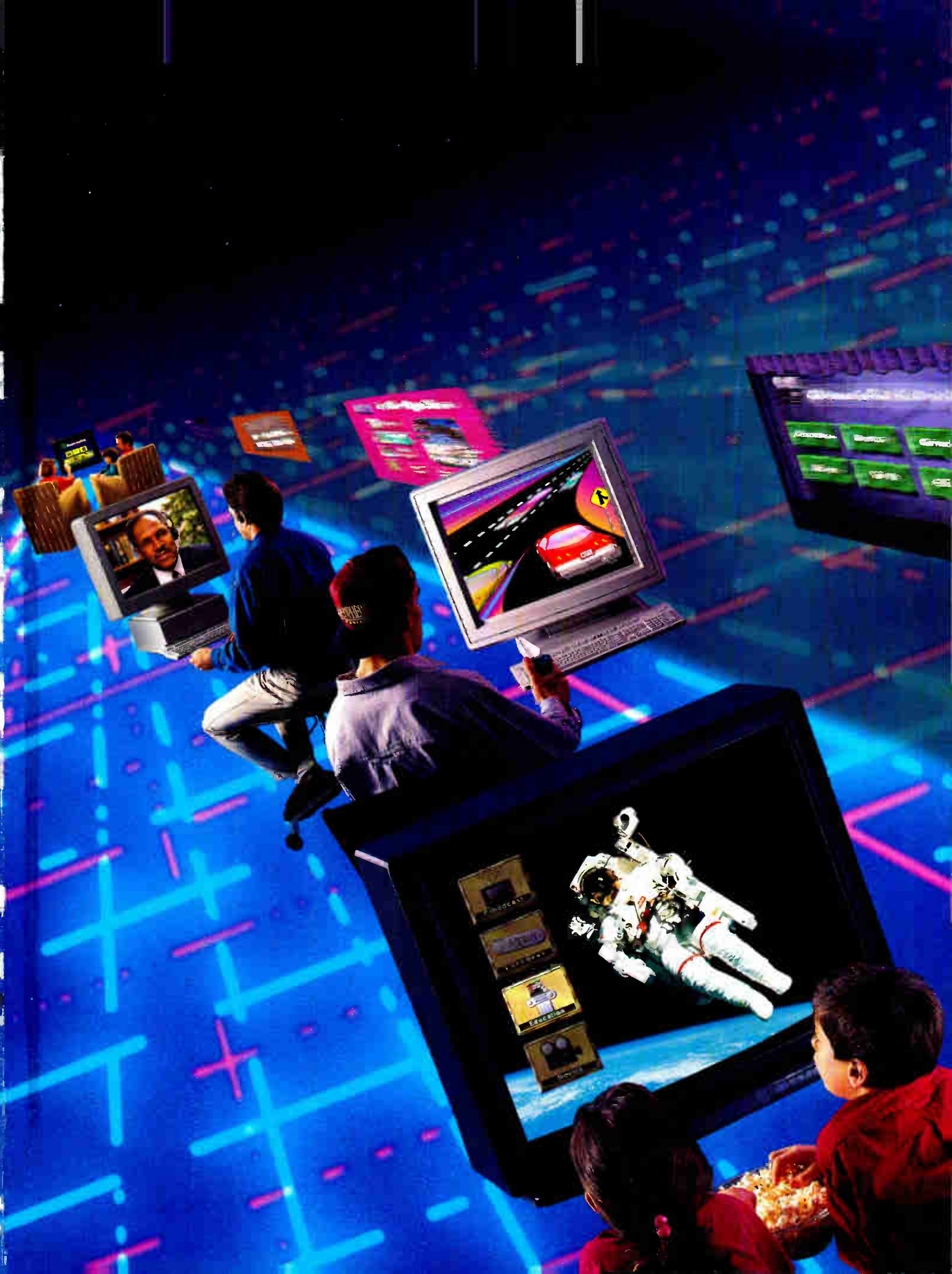
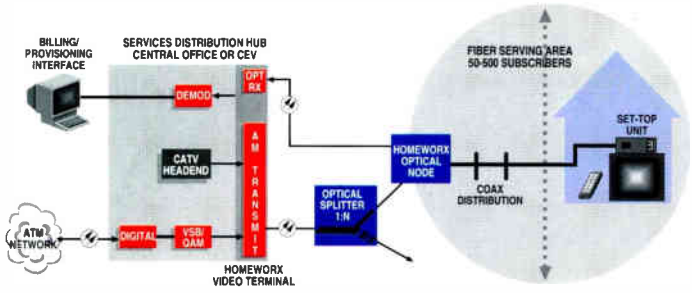


The Homeworx Platform Is The Onramp To The Information Superhighway.

The Homeworx access platform is a fully integrated loop transport system consisting of telephony and video subsystems. These subsystems can efficiently support either a video first or a telephony first deployment strategy with a clear upgrade path to an integrated system.

Homeworx Video Subsystem

Many areas are served by twisted pair copper networks that adequately support telephony services but neglect video links. Industry trends suggest that the sooner these are upgraded to handle broadband transport, the better. The Homeworx video subsystem can deliver up to 110 National Television System Committee (NTSC) channels of basic and premium video programming over a fiber/coax network.



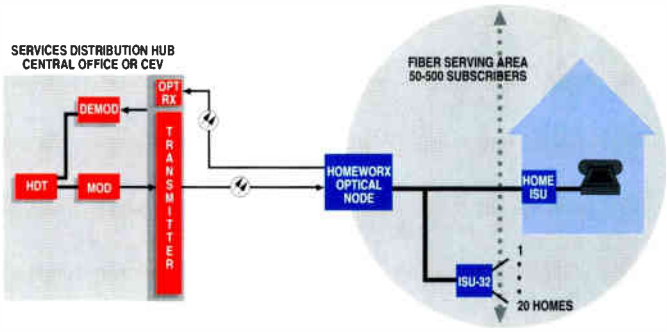
Installing the Homeworx video subsystem in its basic form accomplishes several things:

- Penetration of fiber into the distribution network
- Affordable entry into video services market
- Early deployment of a versatile, long-term platform
- Easy delivery of advanced broadband services.

In addition, service providers who use the Homeworx platform can easily diversify their video offerings by adding reverse-path optical equipment to handle the upstream signaling requirements of interactive video services.

Homeworx Telephony Subsystem

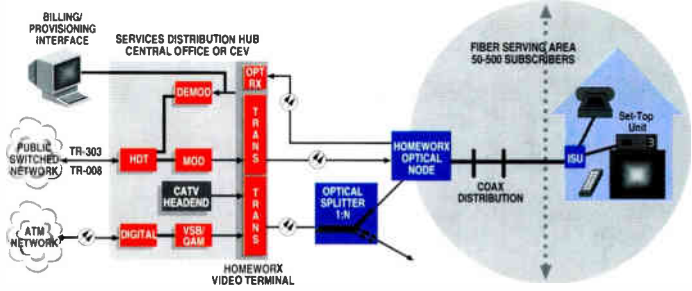
When telephony services are required first, the Homeworx platform provides a flexible, economical



solution. Signals from the Homeworx host digital terminal (HDT) can be modulated onto a Homeworx transmitter to support telephony services over the fiber/coax plant. An integrated services unit (ISU) can be placed at the curb or in the home to provide access to POTS, ISDN, DS1 and other special services.

Homeworx Hybrid Fiber/Coax Integrated System

For combined telephony and video services, the Homeworx subsystems can be upgraded to an integrated narrowband and broadband delivery system. Unique to ADC's Homeworx platform is the ability to upgrade existing headend or central office video electronics without wholesale replacement of remote electronics. This makes it both technically and



economically feasible for service providers to begin deployment of basic and interactive CATV services today while building the network infrastructure to support tomorrow's integrated broadband services.

For more information on the Homeworx access platform, call us at **1 800 366-3891**.

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Pacific Bell, for example, expects to lower its network costs by up to $50 per line annually, easing pressure on cash flow and allowing the company to pursue an accelerated network deployment plan.

The opportunity to extend bandwidth to the home, combined with the high capacity and functionality of advanced multiplexing and modulation techniques, has telcos this year not just evaluating network architectures, but in a position to make investment decisions.

For MSOs, long familiar with hybrid network technology, the prospect of integrated network platform development offers both the digital switching and data processing required to deliver interactive content to homes. Additionally, new broadband technology can move the entry cost of adding telephony low enough to warrant consideration of delivering to subscribers advanced telecommunications services.

Testing interactive TV

On the digital services front, Viacom and AT&T this year will begin testing interactive television in Castro Valley, Calif., using a two-way network configuration capable of supporting digital and analog signaling. Content for the trial will be hosted in an AT&T video server, which will feed information via OC-3 to an asynchronous transfer mode (ATM) switch. The switch is interconnected to an FT 2000 lightwave system and will send signals via an OC-48 link to another FT-2000 system in Viacom's headend in a nearby facility.

In Viacom's headend, a DS-3 interconnection will route the signal through digital RF modems into an RF combiner, then distribute the signal through Viacom's hybrid network into Castro Valley.

The trial is a test of both the market and technology, and will be a real-life example of how interactive video programming will be "hosted" on the network. Programming will first be delivered to AT&T's Manhattan, N.Y. digital production facility and tested in a server/ATM environment, then transported via DS-3 to the AT&T video server complex in Pleasanton, Calif.

In another example of how convergence is affecting MSOs and LECs, the same AT&T video server and ATM switch used for Viacom also will be used for the Pacific Telesis Video Services interactive TV trial in nearby Milpitas, Calif.

After content is loaded into the Pleasanton server from New York, an OC-3 connection will take the Sonet signal from the ATM switch to the FT-2000 lightwave system, then delivered via OC-48 to another FT-2000 at Pacific Bell's headend in Milpitas.

Recognizing the value of open architecture and FT-2000 capacity, the path from FT-2000 to the digital RF modems and the RF combiner in Pacific's headend nearly duplicates the architecture found at Viacom. From Pacific's headend, signals will be distributed to homes on Pacific's new 750 MHz hybrid fiber/coax system.

Servers and set-tops

The server for these trials is configured to handle service for around 5,000 households and will support 600 simultaneous users accessing 50 movies. For interactive content other than movies, the server will have 250 hours of interactive programming supporting 200 simultaneous users.

The prototype set-top boxes for both trials will use MPEG-2 standards, receiving movies at 3 megabits per second (Mbps) and other interactive programming, like multi-player games, at 8 Mbps. In addition to the delivery of content, this integrated services platform will be capable of delivering up to three live video streams, running at 9 Mbps from the server into the household.

As these trials and others nationwide help sort out protocols and the mapping of such transmissions into ATM cells, MSOs and LECs will continue to come face-to-face with "bet the business" decisions on network design.

Cable is no longer alone in setting the agenda for upgrading to hybrid networks or in the design and deployment of consumer devices like set-top boxes. LECs no longer are the "owners" of the development of switching technology. However, to the benefit to both cable and telephone companies, the convergence of technology between MSOs and LECs has created the opportunity to evaluate network design from the headend all the way out to the set-top box, including the "video server complex," digital switching and transmission equipment.

Thinking new thoughts

As interactive television moves from the trial stage toward commercial deployment, the true costs of delivering services will move to the top of the priority list for cable and telco providers.

The margins required to remain a viable business in the Information Age will require very close attention to the economics of network design and construction, which means every component in the drop/loop needs to be part of the business plan.

As LECs look beyond regulated services, they need to depart from traditional costing to include in the equation electronics like set-top boxes, video managers and headend equipment. MSOs now must build into the business plan integrated services platforms that include ATM switching and video server components.

Perhaps equally important, as consumers begin expecting flawless delivery of interactive services, cable and telco are faced with significant systems integration challenges. Piece-parting together an integrated platform for a mix of analog and digital residential services increases the risk of service disruption and poor reliability. As many in the cable and telco industries are beginning to understand, the deployment of video servers, for example, requires an approach that suggests servers are not stand-alone devices, but integral parts of the network and a close relative to ATM switching fabrics.

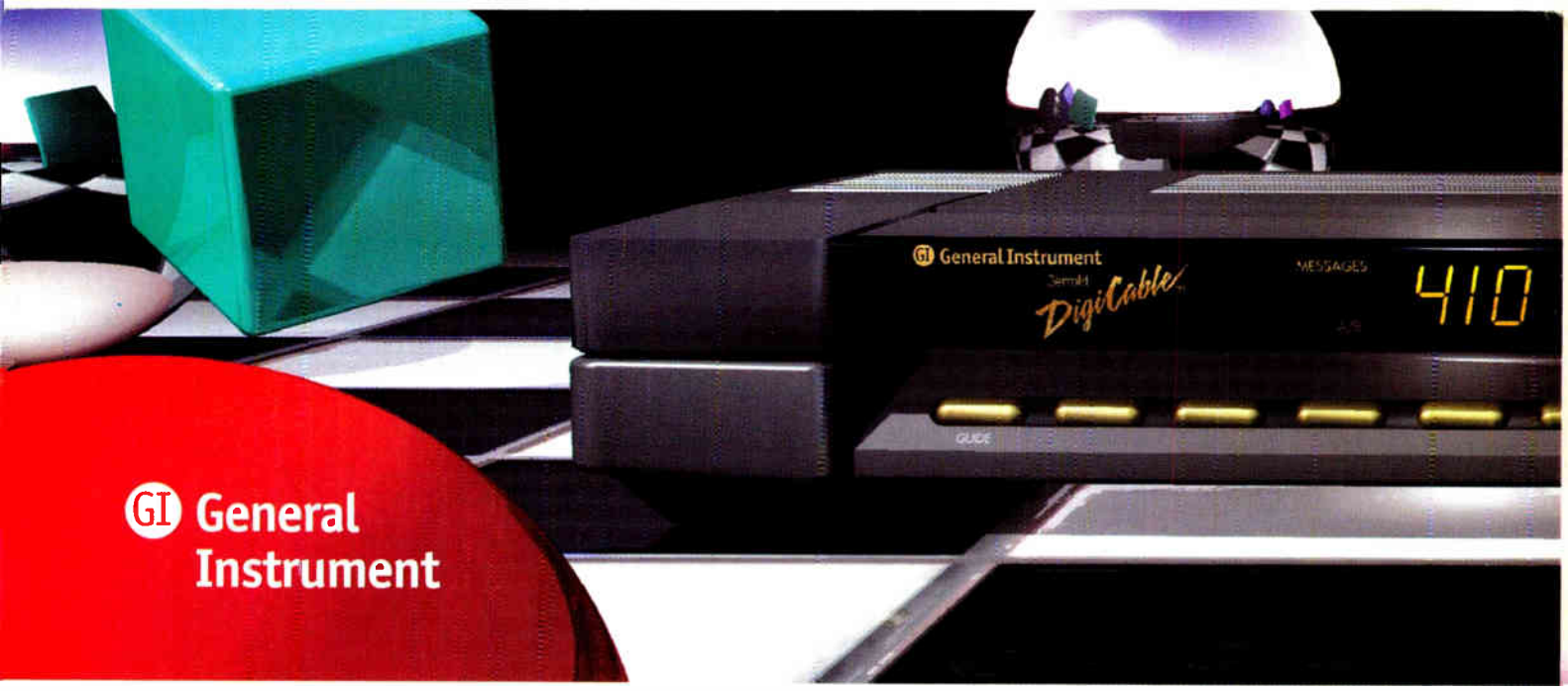
The same goes for digital set-top boxes. Although it remains unclear how consumers eventually will obtain the processing power needed to use interactive television services, the technology inside digital set-top boxes can influence network architecture decisions all the way back to the headend and video server complex.

The protocols necessary for switching cells is directly related to the modulation performed at home, requiring LECs and MSOs to closely evaluate VSB (vestigial sideband) and QAM (quadrature amplitude modulation) systems for set-top boxes.

Total solutions approach

This "total solutions" approach to building networks–from providing equipment to helping adapt content to the network–has become increasingly important not just to cable and telco network planners, but to the marketers and financial officers involved in making investment decisions. Network design remains an engineering art, but it best practiced now with all of the pieces assembled into a chain that can be evaluated as a single unit.

One of the significant changes coming to LECs is the consideration of transaction pricing compared to "time and distance" pricing. With cable, the opposite may prove to be true. In both scenarios, the economics of upgrading networks plays a direct role in the cost and price of new services. Emerging broadband technologies are providing for the first time the opportunity to evaluate the total network, enabling competitive MSOs and LECs to lower operational costs, protect their base of customers and generate new revenue. CED



Set-Top Terminal Manufacturers

84

984

Eagle
General Electric
Hamlin
Jerrold
M/A-Com
Magnavox
Oak
Octagon-Scientific
Panasonic
Pioneer
Regency
RMS
Scientific-Atlanta
Sprucer
Standard Components
Texscan
Tocom
Toshiba
Westinghouse
World Video Library
Zenith

84

994

Apple Computer
AT&T Network Systems
General Instrument
Hewlett-Packard
IBM
Panasonic
Philips
Pioneer
Samsung
Scientific-Atlanta
Sony
Thomson Consumer Electronics
Zenith

"Genius" cards that are being developed.

Zenith Electronics, which had not announced any new orders for set-tops in recent memory, is shipping a new, two-way analog unit, called Multimedia 1, to both KBLCOM and Greater Media for deployment in their systems. This unit, too, offers new on-screen graphics capabilities that are entirely downloadable and configurable by the system operator. Resident within the unit is an EPG decoder that is compatible with StarSight and other text and info services.

"This box is literally an open book," notes Vito Brugliera, vice president of technology market planning at Zenith. Brugliera declined to discuss internal features of the box, but said the operating system has been optimized for the display of program guides and to handle transactional services. "We've been the only ones out there doing real-time interactivity for the past 10 years," notes Brugliera. "We think we know what works in an interactive environment."

The digital units

With the network video entertainment industry poised to go digital next year, however, those same companies will soon unveil their first digital boxes to the industry. Their need is being driven, of course, by the advent of digital video compression, which promises to significantly expand the number of "channels" available to subscribers. The units are expected to begin rolling out early next year after experiencing delays caused by the MPEG-2 standardization process.

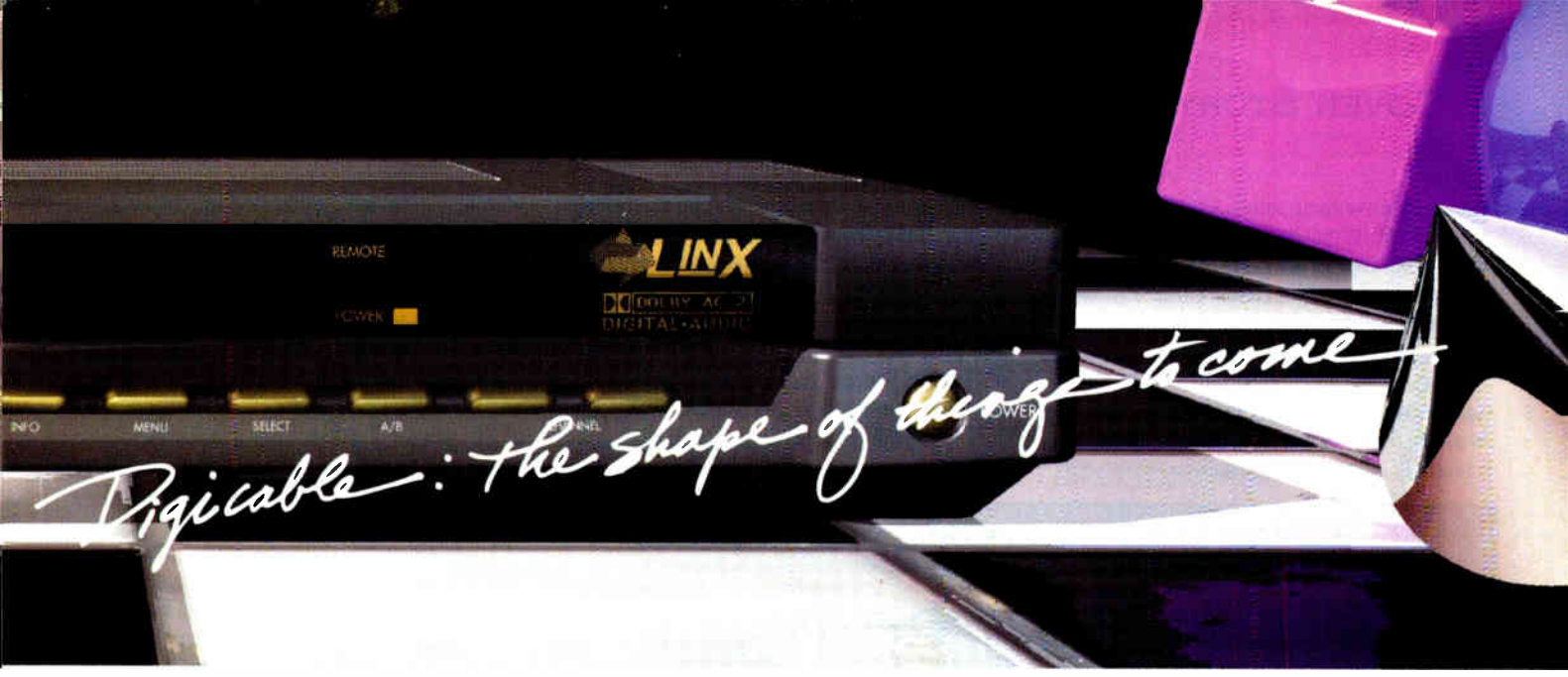
S-A will build on its 8600X analog platform to construct the 8600XD, which will receive digital signals, decompress them, and pass them along to the TV. The unit will be MPEG-2 compatible and uses a Motorola class 68X processor, says David Levitan, vice president and general manager of subscriber systems.

A variant of that set-top, one which will incorporate GI's proprietary DigiCipher II decompression, will be supplied to TCI, which plans to purchase 300,000 of the units for deployment throughout its systems.

The next step up–the one that gets a user into switched digital service provision–is already being carved out by S-A engineers. S-A's 8700 set-top utilizes the PowerPC microprocessor to support enhanced memory capabilities and graphics.

This unit is the one that will be deployed in two trial locations, including Orlando (where Time Warner Cable is building its Full Service Network) and Omaha, Neb. (where US West is testing video dialtone). The boxes destined for Orlando will be based on Silicon Graphics' MIPS processor and operate in an environment that includes Asynchronous Transfer Mode (ATM), a high-speed, cell-based transmission protocol. In Omaha, the units will house chip sets developed by the 3DO Company, a California firm that specializes in video games featuring high-quality graphics. The Omaha box is not ATM based, says Levitan.

"There's been a great deal of activity and interest



shown in this (8700) unit," he says. "Some operators will skip what we call the broadcast digital step and jump right into this, whether it's based on ATM or not."

Of course, costs for these units is unrealistically high right now. Industry observers say US West is spending about $2,000 for each unit and Time Warner will put down more than $5,000 per box, but Levitan says time and additional volume will drive the price down into the hundreds of dollars within two to three years. "We've made strategic investments in these units to stay ahead of the technology and knowledge curves," he notes.

GI's DigiCable unit is poised to hit the streets sometime in the first half of 1995, when the first of one million units is shipped to TCI (GI has letters of intent to purchase 1.3 million more units from several MSOs, including Cablevision Industries, Comcast Corp., Newhouse Broadcasting, Sammons Communications, Tele-Cable Inc., Century Communications, Simmons Communications and Viacom).

This unit adds decompression capability to the analog unit scheduled to debut in a few months. It will support both broadcast digital and on-demand services, Moloney says. Aside from what goes on inside the unit, it is noteworthy to list the external ports it's likely to sport, including baseband stereo, a 30 megabit per second data output, an RS232 port, a serial port for high-speed peripherals and devices like printers.

Zenith will enter the digital era next year with a unit that supports both MPEG-2 and the company's 16-level vestigial sideband (16-VSB) modulation scheme. The unit, which was called Multimedia 3 when displayed at a recent trade show, will integrate a chipset jointly developed by Zenith and LSI Logic. the chip, based on LSI's Reed-Solomon forward error correction, will handle adaptive equalization, synchronizing, forward error correction and other functions. The chip will also be able to switch from 16-VSB to the more rugged 8-VSB for video systems that need it.

Additionally, Zenith has partnered with Raytheon Semiconductor to provide the intermediate frequency amplifier/demodulation IC that will perform automatic gain control and phase lock functions inside the box.

Although Zenith has yet to announce specific roll-out sites for its digital set-top, the company has entered into an agreement with ADC Telecommunications to incorporate the 16-VSB technology into ADC's Homeworx loop access platform designed for video dialtone applications. ADC is a developer of hybrid fiber/coax transport and access systems. ADC intends to use the technology to send digital signals from digital servers to the Zenith digital set-top unit.

Pioneer intends to bring just one flavor of digital box to market, sometime in early 1995, according to Paul Dempsey, vice president of the cable and broadcast systems group. The company has been in discussions with GI to license DiciCipher technology, but also intends to adhere to the MPEG standard, he says.

"We realize they (GI) are providing the encryption and conditional access components of TCI's headend in the sky," says Dempsey. "We're going to need that in our receiver."

Pioneer already has agreements with Motorola and C-Cube for chips; in addition, Pioneer presently has a three-chip set for MPEG 1++ (which should be integrated into a single chip by year's end, says Dempsey).

Pioneer's new box will be tested by several MSOs in different systems, along with Your Choice TV.

The new guys

As the digital era arrives, however, traditional outsiders believe the door is being opened for them to design and deploy products in this category. The notion is simple: In a digital environment, bits are bits–and they have extensive backgrounds in digital signal processing that make them strong contenders. As a result, the new players think, the marketplace is giving them a

As the digital era arrives, traditional outsiders believe the door is being opened for them.

access control and entitlement–that's what leads to interoperability. This whole issue will be growing pains to the cable industry; we know, because we've gone through it and have since come back and bet the future of our company on national standards.

"We know how to compete, how to win and how to add value" in an open systems market, Lemus continues. "Anyone associated with the cable industry needs to learn those things. They need to give up a little control, but that's scary right now for them."

Robinson of AT&T agrees. "We will promote open architectures and competition," he says. "Our customers are local exchange carriers and MSOs who have accepted that the world will be competitive and are preparing for that competition."

Even Zenith's Brugliera says a national standard could be a good thing, if done right. The result of such a standard includes compatibility, which is good for the consumer. "Nothing says security should be inside the box," he notes, "there are good solutions that are based on renewable security."

"They need to remember people don't watch computers, they watch TVs."

Welcome to the party

The trend is unmistakable: companies with vast resources and considerable expertise are making a play to serve the set-top box marketplace. But they aren't playing by rules dictated by traditional manufacturers; instead, they're calling for an architecture that would allow interoperability across franchise borders. And they think they have the answer.

"A lot of that could be overconfidence," says Brugliera, who notes that computer companies have never had to supply the volumes cable operators are looking for at the margins they will pay. "They need to remember people don't watch computers, they watch TVs. They're welcome to the peril." CED

Are standards in the set-top's future?

In addition to possible competition, existing cable set-top manufacturers are feeling pressure from non-traditional equipment manufacturers and legislators alike to develop a standard set-top box architecture.

One provision of House bill 3636, authored by Rep. Ed Markey, calls for the FCC to commence a proceeding and report back to Congress on the importance of open and accessible systems and the security concerns between the interface and the set-top.

Outside Capitol Hill there is pressure, too. The Open Set-top Special Interest Group of the Video Electronics Standards Association (VESA) is also floating a proposed standard architecture. The VESA body is dominated by PC makers and semiconductor companies.

According to a news item in Electronic Buyers' News, the design was conceived by Philip Bernosky of Cirrus Logic Inc. It calls for "an expandable, scalable architecture that can be contained in both set-top boxes and televisions," the report said.

In essence, the design calls for a simple box containing a microcontroller that controls modular components that hang off it. In its most latent form, the box would simply interface between the TV and the network. To perform more complex functions, such as decompression and video games, viewers would purchase and insert a series of audio/video interfaces and controllers. In addition, it would be attached to in-home peripherals by high-speed ATM.

The advantage of such an architecture is that the box wouldn't have to know what kind of service is being provided or what peripherals are connected to it, said Bernosky. The simple box would simply have to query and respond and how to route data derived from the network.

The ramifications of such a proposal are huge. It would essentially reduce televisions to simple monitors, a concept the Electronic Industries Association would never take laying down, if EIA's recent comments on compatibility are to be believed. Furthermore, the concept of modularity in the case of set-tops actually introduces more costs than the traditional approach, according to many set-top manufacturers.

Finally, the concept of using ATM within the home is considered by almost everyone familiar with in-home video to be overkill–both economically and technically.

"ATM is an effective means of transporting large amounts of data point-to-point," notes Dan Moloney of GI. "But it has a lot of overhead that may not be needed in headend-to-home transmission." He said a more economical method is to transport MPEG-2 video to the home.

Vito Brugliera, vice president of technology market planning at Zenith, was the only cable set-top representative present at the VESA meeting. His reaction was less than favorable, noting that the idea runs counter to the compromise agreement on compatibility negotiated between the NCTA/EIA joint engineering committee and submitted to the FCC.

Moloney says efforts to standardize cable set-tops is tantamount to drawing a line in the sand technologically. "If the consumer owns the terminal, you'll end up freezing the technology because it needs to be transportable from house to house. NTSC is the perfect example of a frozen technology and look how long it's taken to improve it," he notes.

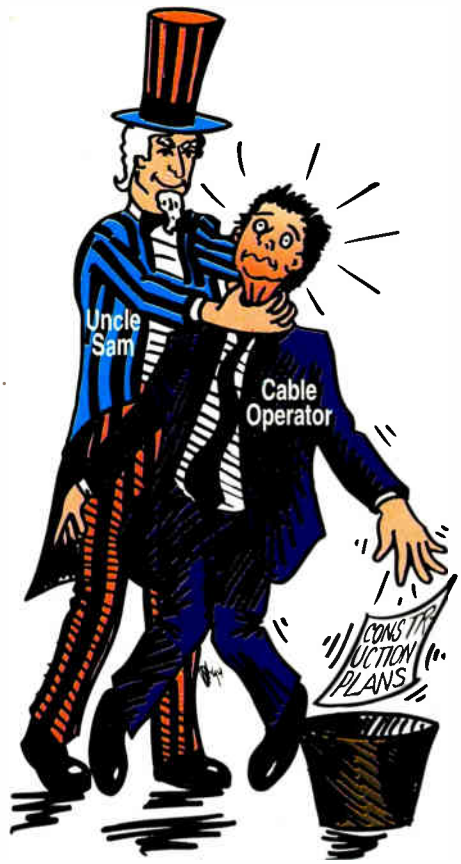
The real issue, according to Moloney, is how to provide the most utility to the consumer. "Can you design something that doesn't freeze the technology, connects to a network and offers functionality? That's the issue that's been struggled with for years."

The next step? The group, which includes representatives from Apple Computer and AT&T Bell Laboratories, will now develop a more detailed proposal and submit it to the full committee. –R.B.

MSO spending heavy despite unsavory environment

Rebuilds, upgrades hit all-time high

By Leslie Ellis



In some cases, federal rate rollbacks are curbing MSO spending plans.

Cable operators will spend an estimated $4.5 billion to put the polish on their national information infrastructures this year, despite unfavorable rate regulation from the Federal Communications Commission that will return 17 percent of their cashflows back into subscriber pockets.

The hefty capital expenditure sum includes all hardware (headend, distribution and subscriber) and labor, tabulated from construction surveys received from 11 of the top 25 MSOs. The results, which were extrapolated to form a non-scientific snapshot of the entire industry, paint a picture of a cable industry that isn't just healthy. It's downright glowing.

The results contrast sharply from a similar survey CED completed in 1990. Back then, the outlook for spending and plant construction/rebuilds were dismal at best, with some vendors citing downturns of 25 to 50 percent. Others cited their business "hitting a wall" in July of that year, and ruefully looked toward 1991 with hopes for unleashed pent-up demand.

A far cry from last year

Indeed, the construction and expenditures scene has changed radically even over the last year. Last spring, for example, operators openly discussed–almost bragged about, in fact–their specific upgrade and rebuild plans. A case in point is TCI, which last April hosted an elaborate video press conference to announce an aggressive "Infostructure" fiber/digital rebuild schedule, to the tune of $2 billion over four years.

In less formal but just as meaty affairs, Time Warner Cable and Times Mirror openly talked of upgrading their networks to full interactivity by 1996.

That kind of candor simply isn't the case now. This year's survey shows MSOs clearly prefer keeping their plans close to the vest. Several cable operators simply declined to participate in the survey; others requested that their numbers be included only in the aggregate analysis.

The secrecy apparently stems from two immediate threats: competition and rate regulation fallout. With two major telco/cable deals down the tubes, for example–notably, Bell Atlantic/TCI and Southwestern Bell/Cox–the spirit of cooperation between those two industries seems to have taken a step backward. Telcos are again an adversarial force, poised to woo subscribers currently hooked to cable.

Similarly, operators don't want to appear hypocritical to the Washington, D.C. regulatory community by whining about the negative effects of rate regulation in one breath, while simultaneously boasting of ramping up construction activity in another.

But, by the looks of it, that's exactly what cable's MSOs are doing–not because they particularly enjoy putting on two faces, but because in most cases, they simply don't have a choice.

"On the one hand, the federal government really is killing us," said one cable operator who requested anonymity.

"On the other hand, there's formidable competition shaping up that we need to protect ourselves against. So we have to tell regulators the truth: that the rate rollbacks are very painful. At the same time, we have to ensure the lending community that everything's fine. Otherwise, how can we gear up against the DBS, wireless MMDS and other players who want to each our lunch? It's a lose-lose situation; a bonifide catch-22."

While rate rollbacks are painful to ops, so is potentially lost business to competitors including DBS, MMDS and others.

Past and future construction plans

By all accounts, 1993 was a banner year for vendors, many of whom say they broke long-standing company revenue records and saw the industry as a whole leapfrog 1990, 1991 and 1992 spending patterns–which were flat at best.

According to the survey, the industry unleashed $3.4 billion in capital last year–a significant jump from earlier years. Across the board last year, spending was up, in headend

cation for the Consumer Electronics Bus (CEBus). The importance of this specification is that the set-back box mentioned later may use this protocol for the control application. The main problem with this specification is that it is set up for all-purpose use, with specific application to power line control. As a result, the data rate is only 9,600 baud. The application to set-back decoder use would like to have a lower latency (higher data rate) solution. There is a possibility that a sub-set of the transmissions layer of CEBus could be adopted.

✔ IS-105. This is the next generation of EIA-563 (formerly IS-15). This specification will describe the interface for a set-back descrambler box. The idea is to use the TV or VCR tuner and all normal TV functions while passing the scrambled (controlled access) signals out to a set-back descrambler, which returns descrambled signals for display. Conceptually, this idea has been around for a long time.

IS-15 was the first failure at this idea. After a couple of years in which about 2 million TV receivers had a connector to implement the desired function, and about 3,000 descramblers meant to interface to those connectors were built, a final standard with different functions was released as EIA-563. No TVs, VCRs, or descramblers were ever built to EIA-563 specifications. The FCC has said that if the cable TV and consumer electronics industries do not supply an alternate to EIA-563, the FCC will mandate that all TVs and VCRs sold as "cable ready" have an EIA-563 connector.

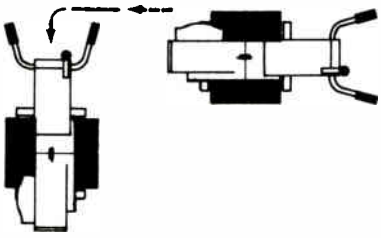
The joint industry committees are working feverishly to define IS-105. The new proposal has an unfiltered IF output so that all but the tuner function can be built into the set-back descrambler.

This doesn't seem to be a low-cost approach, but it is known from past experience that the alternative to bringing demodulated video out to the descrambler doesn't work either. An alternate approach which brings an IF loop-thru out to the descrambler has been considered too difficult, although such an approach would reduce function redundancy in the descrambler.

The FCC has proposed the deployment of this equipment by making it available to the consumer without any separate installation charge or monthly rental fee. Unless some creative billing methods are employed, this proposal may be doomed too.

✔ EIA-16a and EIA-544. These specifications relate to the interference rejection capability of TV and VCR tuners to frequencies from 0.5 MHz to about 30 MHz. EIA-16a considers direct pickup while EIA-544 considers interference from signals generated internally from antenna terminal or internal electronics. This type of distortion has been a concern with short wave transmitters and, more recently, citizens band transmitters. The rejection has been pretty well controlled and has not been a problem in cable TV systems using two-way. There is a concern that more upstream data usage will, in fact, create a problem and that with trunk and distribution plant amplifier cascades becoming shorter, cable TV systems will have significant RF levels coming out of convertors from 30 MHz to 42 MHz and in the case of telephony, on a continuous basis.

The EIA is particularly concerned that cable TV operators do not put out any significant energy above 41 MHz where the TV/VCR IF band resides. The EIA has a questionnaire out on the expected RF levels that will appear at the input terminals of TVs and VCRs. CED



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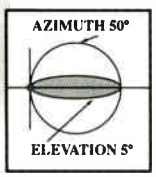

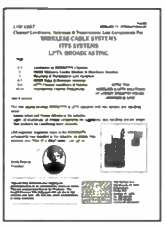

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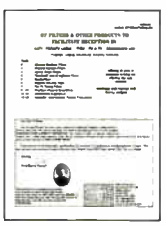

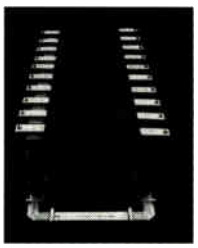

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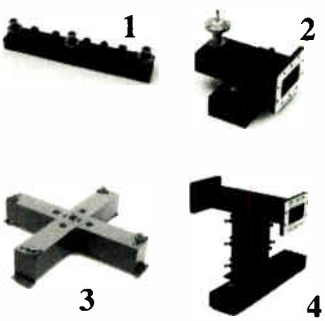

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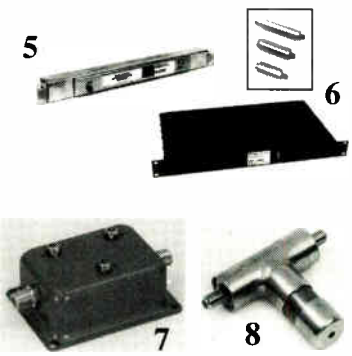

***Glyn and Emily Bostick have been designing and marketing products for the communications industry for 25 years. They have produced many *firsts* for the TV industry. They founded Microwave Filter Company in 1967 and were its chief executives until April, 1992, when they left and started Communications & Energy Corporation.**

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What is a demarc box?

Achieving a "seamless" drop

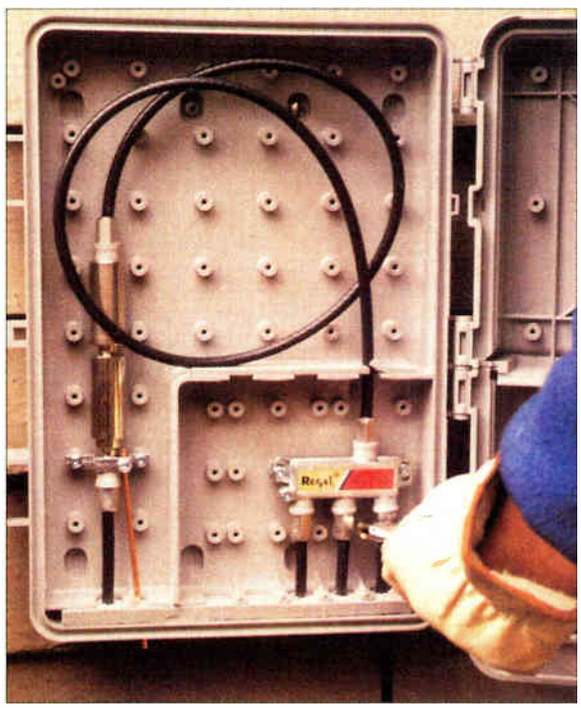
By Frank Priebe and Tony Nieves, Keptel Inc.

For years now, CATV systems and key system integrators have made substantial efforts to provide better subscriber components that help maintain and improve signal integrity to the side of the home and into the TV set. To date, the key improvement drivers have been bandwidth growth, prevention of radio-frequency interference (RFI), digital signal deployment, and a serious effort to save money on service calls.

Since 1991, some manufacturers began development on 1 GHz-level drop components. These products have been refined to pass very high bandwidth signals when the system reaches the 750 MHz threshold and beyond. To maintain a robust signal at these levels or even transmit the much-awaited digital signals, the composition of the subscriber drop has to be as "seamless" as possible. The electrical and environmental demands placed upon drop components in existing analog and future digital systems will become greater as higher bandwidth and return path systems are implemented.

The expanding deployment of hybrid fiber/coax topologies in cable systems brings with it a wealth of opportunities for system operators to provide a wide breadth of services. Indeed, the convergence which seems inevitable in the telecommunications industry brings with it new ways and approaches in addressing the handling of the subscriber's drop interface. The addition of more channels via increased bandwidth offers revenue advantages, but also presents numerous challenges. The most noted problem is at the subscriber's drop. It has been estimated that up to 80 percent of a CATV operators' service calls are attributable to drop-related problems.

Current CATV drop arrangements, inadequate installation practices, substandard cables and components, environmental issues such as corrosion, and increased equipment add-ons all contribute to signal degradation. The low-quality video and audio signals that are generated at the subscriber's television set as a consequence of this environment will result in a trouble complaint which, in turn, requires a truck roll. The sources of these problems tend to rest in the interconnectivity of drop components, such as ground blocks, splitters, traps and the infamous F-connector interface. Protecting these components is one method to substantially improve their longevity while maintaining the performance of a high-bandwidth network.



Enclosures like this one minimize coaxial bend ratios and add extra room for future expansion.

Industry standards

Telephone companies have historically terminated their drops in an enclosure which mounts on the outside of customer residences. Prior to the AT&T breakup, this same enclosure was used to protect the drop connection point–which usually consisted of a grounding/bonding connection and some sort of lightning protection device. Following the breakup, this enclosure has evolved into a demarcation point designed not only to handle grounding and protection, but also FCC-mandated demarcation test jacks (see Figure 1).

Because the enclosure needed to serve as the federally-mandated demarcation point of service, it needed to be designed to allow accessibility by both the telephone company and the subscriber. So, Bellcore and Underwriters Laboratories created industry standard specifications to ensure the longevity of internal components while maintaining subscriber safety, all via the demarcation enclosure.

With the requisite telco "20-plus" year mindset, in terms of product longevity, certain key tests were designed to ensure the longevity of internal components, the enclosure itself and the needed subscriber safety. Some of the key tests and requirements are illustrated in Table 1.

But why should a "demarc box" have to pass such specifications? Because geographically, the United States experiences climactic conditions which vary widely–from cold temperatures of -40°F to high temperatures to 115°F. Humidity levels range from below 20 percent to above 95 percent; snow blankets some areas nine months out of the year while in other areas, sunny days prevail during those same nine months. All of these environmental conditions can wreak havoc on a poorly-designed enclosure and its internal components.

The properly designed demarc box should be able to withstand cold-weather snowballs and shovels as well as warm weather lawn mowers and rakes. It should be designed to resist breakdown and cracking when sprayed with insecticides, or when painted with different types of paints. Further, it should always protect the network and the subscriber from any undo harm. Such is the mantra of most enclosure makers.

When designing a demarc box with these types of requirements, the materials used in its construction must, therefore, be carefully selected. Generic types of plastic enclosure materials, for example, are usually an unwise choice, because they do not meet the specifications listed in Table 1. Some materials may meet UV and chemical resistance tests, but lack cold temperature impact resistivity and/or flammability criteria. It takes careful engineering analysis and extensive testing to develop blends of plastic materials that will meet all of the requirements. While the use of metal to fabricate enclosures may pass most of the environmental tests, costs for these types of products are typically higher than plastic enclosures.

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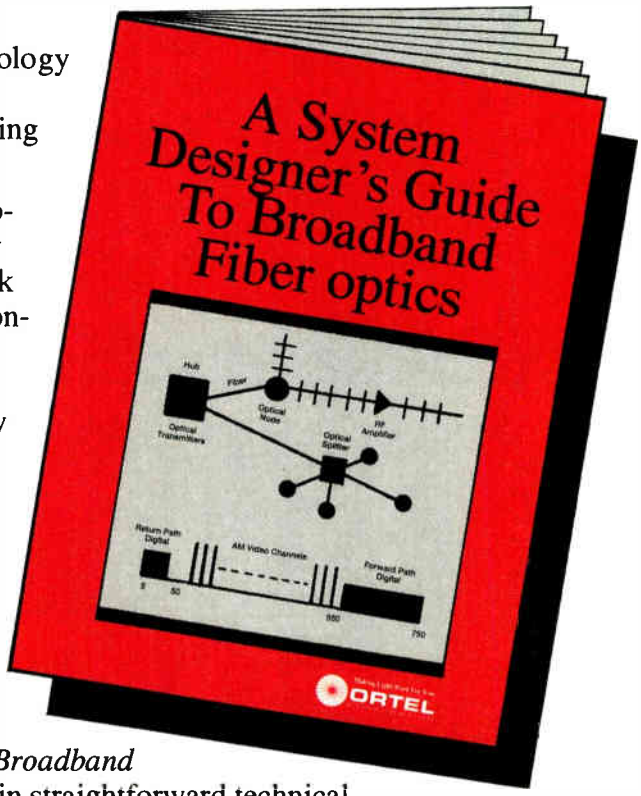

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Furthermore, with these requirements, CATV companies are now starting to deploy their own kind of demarcation enclosures, which deliver higher performance and quality service to the subscriber.

Finally, the 1992 Cable Act describes the need for a clear demarcation point for termination and responsibility of service. Being able to systematically house existing components, such as ground blocks, traps and splitters, along with future equipment such as smart electronics and upstream signaling devices, is likely a big concern to cable system operators. The knowledge of a secure drop will help raise the quality of the network to give the subscriber the comfort factor desired.

Operators examine standards

The standards that regulate the telephone industry have evolved over decades of time and experience. The desire to create a plant service life of 20 years or more, for example, is not uncommon.

Similarly, the cable industry is starting to develop its own standards, via the Society of Cable Television Engineers and Cable Television Laboratories. Recently, the SCTE formed six engineering subcommittees composed of cable operators and CATV equipment suppliers to address industry safety, CLI testing, equipment, construction and maintenance procedures. While the goals of the two industries standards-setting activities are still different, cooperation is starting to emerge. A case in point is Bellcore, which now attends SCTE standards-setting meetings.

Table 1: ***Bellcore Demarcation Point Specifications***

Flammability: UL 94-5V
High Temperature Storage: 159° for 14 days
Dielectric Strength: 2500 Vrms for one minute
Salt Fog: 60 days per ASTM-B117-90
Temperature Cycling with Humidity: 40°F to +140°F for 150 days
UV Resistance: 60 days per ASTM G26-84
Cold Temperature Drop: -40°F, five feet onto concrete surface four times
Cold Temperature Impact: -40°F, 5 ft./lb on all external surfaces
Torque: 20 in/lbs. min
Driving Rain: 10 psi for 24 hours
Chemical Resistance: Resist cracking when exposed to house paints, wasp sprays, sulfuric acid, kerosene, sodium hydroxide

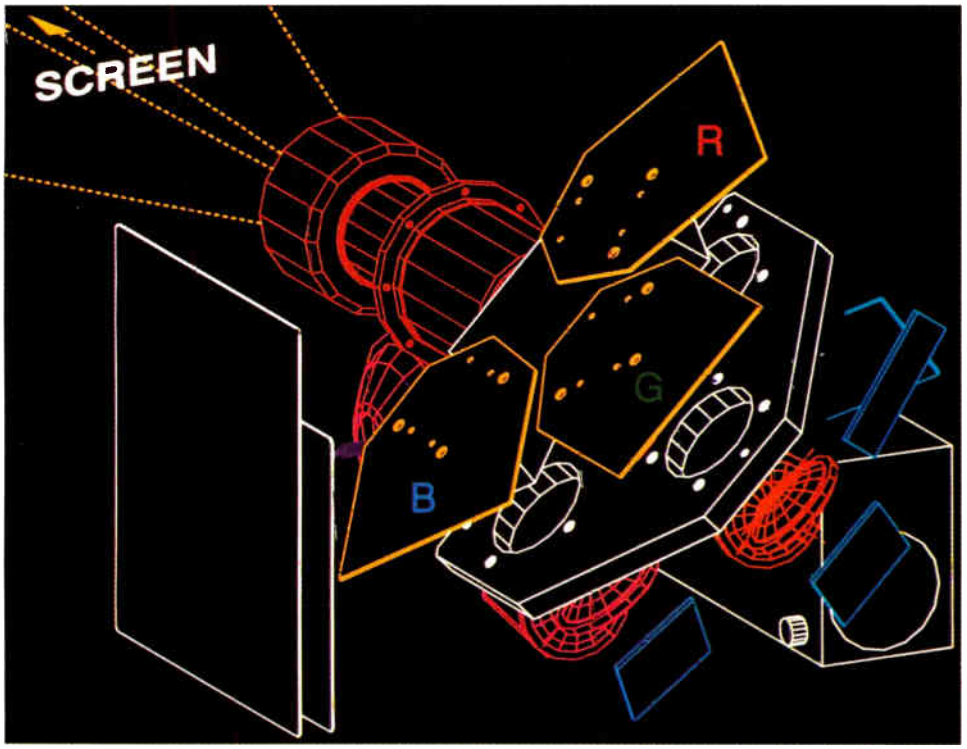
Competition, direction set by the Cable Act of 1992 and the efforts of leading MSOs all point to the need to hand-off a high quality signal to cable television subscribers. The demarcation point and the point of presence for the cable television system should reflect the quality of the entire network. Therefore, the thought of a 20-plus year lifetime for demarcation products is probably warranted.

With many changes in transmission technology, the demarcation box should be flexibly designed, allowing future upgrades of internal components without having to install an entirely new enclosure. Finally, strict quality adherence should be followed, including present and future SCTE, Bellcore and ISO 9001 standards

Because of higher performance standards and higher bandwidth requirements, cable companies are seeing the need to improve the drop portion of their plant. Particularly in future digital environments, where signal quality relates to a completely different set of variables, component protection from the elements is an important consideration. CED

Breaking ATV out of the CRT bottleneck

Flat-panel displays coming soon



A CAD representation of Texas Instruments' mirror-based projection system.

By Fred Dawson

Advanced television display technology has outpaced expectations in recent months, suggesting that a much-needed spark to light up the superhighway arcade may be near.

In fact, it now looks as though ATV technology will be reaching commercial threshold just as the first full service networks, a year and a half to two years hence. Full-resolution HDTV on a six-foot wall screen at home, even in daylight, is on tap within that timeframe–for under $1,000 per display system, says one developer–and at least one Japanese firm is already marketing portable computer/TVs with 21-inch display panels, setting the stage for rapid advances in flat-panel technology in the year to come.

Progress in these two realms–entertainment projection systems and flat-panel computer/TVs–together with completion of the major ATV protocols by the Grand Alliance of HDTV developers, opens important opportunities for network transport operators, if they are ready to accommodate the possibilities with digitization of TV signals and appropriate allocations of bandwidth. In contrast to the prospects for huge HDTV sets from the CRT (cathode ray tube) era, the slick new means of conveying better picture and sound in living rooms across the country promise to afford a competitive edge to whomever offers services at advanced quality levels, whether they be network operators, DBS suppliers or retail multimedia outlets.

The speed of development has caught many media developers and the experts on flat panel systems who advise them by surprise. "There's a new game in service development tied to high-resolution, as opposed to widescreen HDTV per se," says a senior executive at a cable network, asking not to be quoted by name. "But a lot of people aren't seeing it."

Those who do look at things this way believe higher visual and sound quality will add premium value to all types of video services, especially among subscribers who own advanced display systems. These subscribers, of course, will also be the market for widescreen ATV, which many believe will be a key to success in movie-on-demand services.

"This is an area of intense development worldwide, with investments in the hundreds of millions of dollars," says Craig Tanner, vice president of advanced television projects at Cable Television Laboratories. "People seem to be a lot more convinced of the commercial payoff in advanced display technology now than they were awhile ago."

A scene typical of the development pace recently unfolded at the Silicon Valley quarters of the Advanced Research Projects Agency, the successor to DARPA, where a group of industry and government flat panel display experts watched the 1994 Super Bowl on a 30-inch (diagonal) plasma flat panel display system developed by Photonics Systems. The company is a leader in applications of the 20-year-old optical technology, which, in the latest iteration, uses electrically-induced ultraviolet photonic emissions in inert gas to trigger photonic emissions from red, green and blue phospors.

Clear, quality-color video on a plasma panel of this size was thought to be well off in the future. But, by the accounts of participants in the demonstration, the system was on a par with CRT TV quality from a subjective standpoint, though, technically, it fell a little short of state-of-the-art TV set performance specs.

Roger Johnson, a government consultant with Science Applications International Corp., who watched the game on the thin plasma display panel, was surprised the technology had gone so far. "It was our first look at it," he says. "It's not that far from meeting our performance goals for flat panels in the 21-inch to 25-inch range."

Government backing exotic solutions

Government interest in what some experts believe will be a $20-billion market for advanced display systems in all fields by 2000 has helped resuscitate the once flagging domestic R&D effort in advanced flat panel displays, as have new investments in display system startups by Motorola, Xerox and other major manufacturers. Military, industrial and PC-based multimedia applications of every stripe stand to benefit from improvements in display technology.

Equally important in these areas, and to entertainment applications as well, the digital processing used in advanced display systems lends itself to increasing the speed and complexity of digital interactions with users. Advanced flat panel technologies such as active or passive matrix liquid crystal display, field emission display, micromirror and diamond emission all operate on a digital circuit coded platform, offering far more speed and flexibility for computer-based media applications on- and off-line.

Eventually, "the computer will be indistinguishable from the screen," says Larry Fennel, a Xerox Research Center engineer who is a member of the technical council for the U.S. Display Consortium, the primary funding conduit for R&D stipends from ARPA. "If U.S. industry wants to be part of the computer business after the year 2000," Fennel adds, "it can't be behind in this sector."

Space-age inventions aimed at capitalizing on the market for flat panel systems proliferate in the U.S., all of them cheered on by defense officials whose only source of 14-inch AMLCD panels as standalone components is the Sharp catalog. Not only is this the case, says Darrell Hopper, an Air Force procurement officer looking for flat panel systems for advanced fighter cockpits, but Defense must conceal its identity in order to acquire the much needed devices without setting off alarms in the Japanese government. "We had a deal for a 19-inch display system for AWACS (advance warning airborne communications systems) killed because the government found out," he says.

Diamond solutions

One of the more broadly backed U.S. techniques involves field emission displays, which are meant to reduce the power consumption and luminance limitations of AMLC. In FED systems each pixel is represented by an electron emitter, which, when stimulated by an incoming current, projects a burst of electrons onto a phosphor-coated film in front of the emitter. The phosphor film strips are positioned in rows to match the red, green and blue color lines of pixels in a TV display, so that, depending on the way the electronic signals to the emitters are patterned, a block of pixels can show any color.

One of the more exotic systems built around the FED concept comes out of a Houston-based startup, SI Diamond Technology, Inc. The company, using thin diamond manufacturing techniques and exploiting the low-power semiconducting qualities of the material, has won the technical support of Microelectronics and Computer Technology Corp., a research consortium whose members include 3-M, Digital Equipment Corp., Hewlett-Packard, Hughes Aircraft, Motorola, Northern Telecom and close to 70 other manufacturing concerns.

"We believe the diamond field emitter display technologies included in this pooled (technology investment) package have the potential for gaining a significant price/performance lead over future active-matrix, liquid-crystal and all other flat panel display technologies now under development," says Dennis Herrell, vice president for high value electronics at MCC.

MCC has been working in FED technology for some time. The choice of diamond as the material for field emission displays reflects the material's high energy electron emission properties at low power as well as the material's hardness, says MCC spokesman Bill Stotesbery.

SI Diamond recently teamed up with David Sarnoff Research Center to produce color phosphors and screens for the system. The venture provides SI Diamond ready access to a wide range of ATV technologies, including color phosphor techniques.

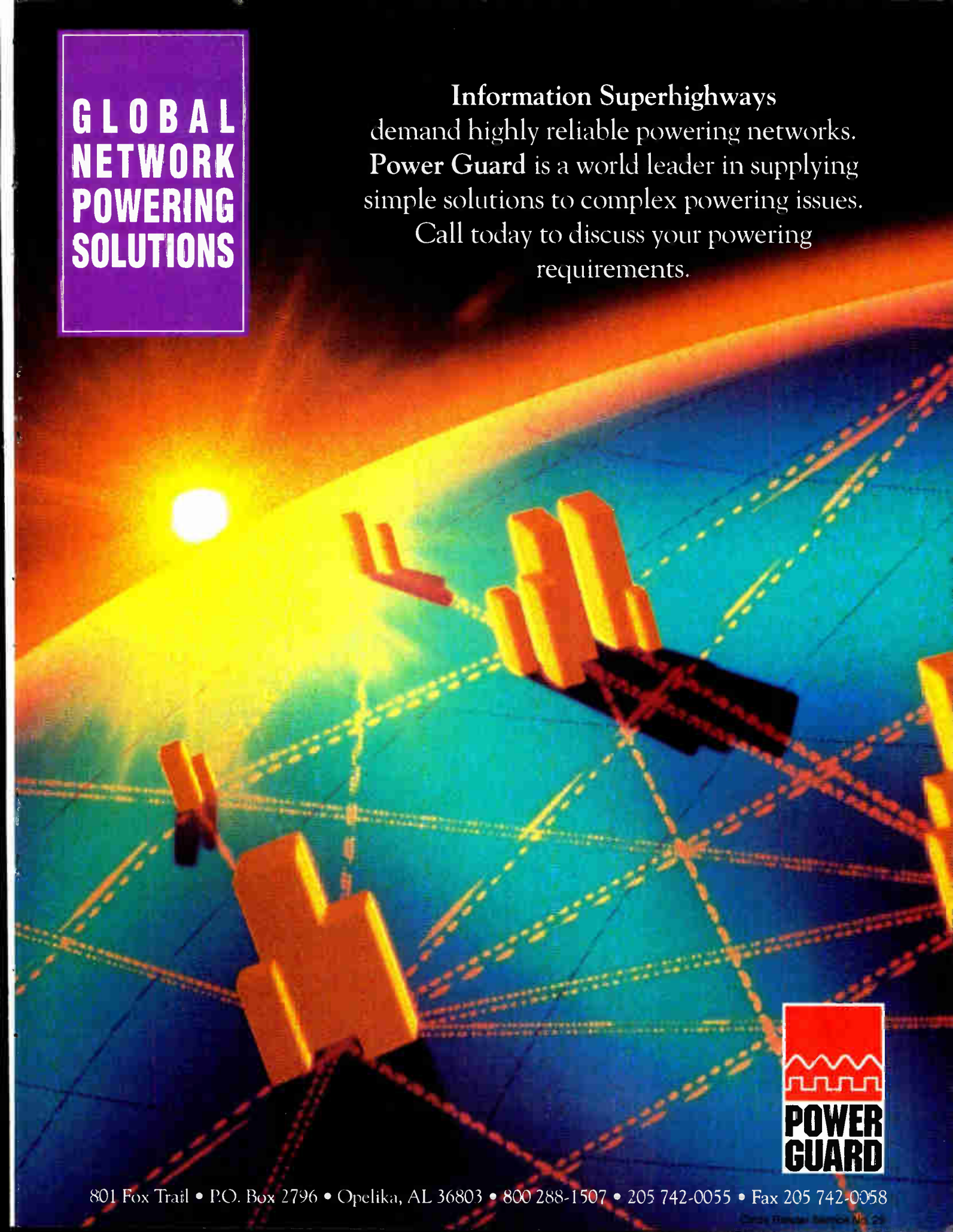
Where conventional FED systems have had trouble with the contamination of cathodes by sulphur deposits from the zinc sulfide phosphors that are used to generate color, the diamond cathodes are resistant to sulphur, notes SI Diamond founder Howard Schmidt. .

Glenn Cullen, head of advanced materials development and applications for Sarnoff, is effusive in his praise for Si Diamond's technology. "We think that the use of diamond-thin-film as a cathode is one of the great advances in U.S. display development," he says.

Way out in front in Japan

Notwithstanding such enthusiasm for these intriguing developments, U.S. interests appear to have their work cut out for them. "If I had to say today what the winning technology will be I'd pick tiled AMLCD," Hopper says. (Tiling refers to new techniques allowing manufacturers of the silicon sheets on which circuits connecting pixels to electrical sources are etched to piece the hard-to-make individual substrates together into larger panels.)

"Active matrix has achieved the pixel density required for HDTV displays," Tanner says.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"The problem is how to make panels large enough, which involves either tiling smaller individual substrates together or achieving practical yields of very large single panel substrates."

The Japanese leaders in AMLCD continue to outpace projections with commercial rollouts of flat-panel technology at ever higher levels of performance. Last summer, Matsushita surprised the experts with an announcement that it would begin selling 14-inch flat-panel TV sets 10 centimeters thick at a list price of $2,723. Pricey as this may seem for a small TV, Matsushita went forward with the launch and has since been joined in the chase by competitors offering 14-inch product at similar price points, none of whom have been able to keep up with demand.

In the latest instance of beating projections, Fujitsu has just put a 21-inch AMLCD system on the market at least a year in advance of the anticipated timeframe for devices this large. As described by James Nolan, vice president of manufacturing technology at Photonics Systems, the Fujitsu machine, on sale in Japan and priced at about $6,000, operates across a standard 640 x 480 pixel array delivering video with a picture luminance of 58 foot lamberts, which is not far off the 65 FL benchmark in state-of-the-art CRTs.

In AMLCD systems, two matched transistors mounted at each pixel location on the glass panels enclosing the liquid crystal start and stop an electric current that shifts the polarity of the liquid crystal molecules at each point. This polarity shift controls passage of color filtered light from a flourescent or otherwise backlit panel through to the screen.

At the current price, not much of a consumer market is expected for the 21-inch Fujitsu device. Moreover, where media producers are concerned, a 21-inch flat panel with 4:3 aspect ratio and 640 x 480 pixel density is not the device they're looking for to give digital services the high resolution and, when called for, widescreen look that would mark a departure from traditional analog services.

But, as suggested by Hopper and Tanner, AMLCD may offer a solution if several panels could be arrayed into a single largescale display system. Such capabilities have now been demonstrated, with some nearing commercial feasibility.

Success along these lines at a Troy, Michigan company has caught wide attention among government and industry flat panel development leaders. Optical Imaging Systems has invented a low-cost way to combine AMLCD panels while maintaining a seamless image display, which is one reason Tanner and others suggest consumer-level commercial introduction of largescale high resolution flat panel display systems might be as little as four years away.

Fast track for projection systems

Government support isn't limited to flat panel systems alone. Funding is also going into projection systems, where commercial rollout is much closer at hand.

From a network operator's perspective, advances in projection systems employing AMLCD and other high-tech techniques suggest an appealing, low-cost alternative to the CRT behemoth. "We're seeing significant improvements in this area," Tanner says.

Until recently, next-generation projection systems were stymied by problems with low luminance and low pixel density, one resulting from inadequate light power, the other from the difficulties of squeezing hundreds of thousands of transistor points onto the approximately 1-inch square "chips on a glass" which generate the projected image.

In recent months at least three companies have demonstrated they can overcome these and other problems with means that promise low-cost consumer systems will be in the market soon enough to provide support for ATV. One of these firms, RAF Electronics of San Ramon, Calif., is preparing to introduce a high-performance front projection system employing low-cost chip fabrication technology, which its founder says will result in retail pricing of under $1,000 per unit.

RAF's Robert Fiske, one of the pioneers in AMLCD who was unable to win U.S. investment backing, claims the new system delivers pictures at three times the luminance of existing projection systems with four times the resolution. The process employs integrated circuitry in the silicon panels enclosing the liquid crystal, greatly reducing the steps in the active matrix display manufacturing process to where it can be done on a slightly modified standard semiconductor assembly line, Fiske says. The system also uses a "reflective light valve" technique, which he declines to describe.

Even more impressive, in terms of resolution and luminance, is the new projection system developed by Texas Instrument Corp., which also uses mirrors but in a way quite different from RAF's. Here the mirrors, one for each pixel, are turned electronically to flash the light onto the screen whenever the pixel point is supposed to be illuminated. TI displayed a prototype HDTV system at the Advanced Research Projects Agency's High Definition Systems Conference in Washington in early February. The 11- to 22-foot projection delivers an image with sufficient brilliance and pixel density (1.6 million pixels) to exceed HDTV display standards on screens measuring up to 12 feet on the diagonal.

TI's DMD (digital micromirror device) technology, described in the February '93 issue of Digital Media, has advanced rapidly, with this year's demonstration offering a pixel density five times that of last year's projection of NTSC video onto a 60-inch screen. "This technology has the potential for world class, truly digital, high-definition displays at affordable prices in time to serve future emerging high-definition markets," says Jack Younse, TI's program manager for its contract under the ARPA/Air force High-Definition Display program.

While Younse declines to be more specific about timing or costs of the technology, it is clear that whether it's TI's, RAF's or some other developer's technique, high definition projection systems will be available in time to support transmission technology, which will be ready for implementation by satellite.

Another developer, perhaps on the fastest track to commercial introduction, is Projectavision, Inc., of New York, which demonstrated a prototype of its system in January at the Consumer Electronics Show in Las Vegas. While falling short of the performance levels claimed by RAF and Texas Instruments, the system is said to be vastly superior to current projection systems.

The company has licensed the technology to Matsushita and CMC Magnetics Corp., which plan to use it in projection systems before the year is out. System brightness is said to be sufficient to allow viewing in daylight, which has been impossible with current systems.

The message to network planners

With a raft of affordable largescale computer/TV systems queuing up for market entry not long after the projection systems are introduced, it appears that digital media will soon have a shot at breaking free of the CRT bottleneck. As a result, something more than bandwidth efficiency will drive digitzation of TV signals over cable and telephone networks.

Zenith Corp., developer of 16-VSB (vestigial sideband) modulation, and several developers of 256 QAM (quadrature amplitude modulation) are in the chase to deliver systems supporting delivery of two HDTV signals over a single 6 MHz cable channel. But even at these ratios, an early market surge, especially with regard to ATV point-to-multipoint services, could squeeze the bandwidth allocations now scheduled by many cable and telephone companies. CED

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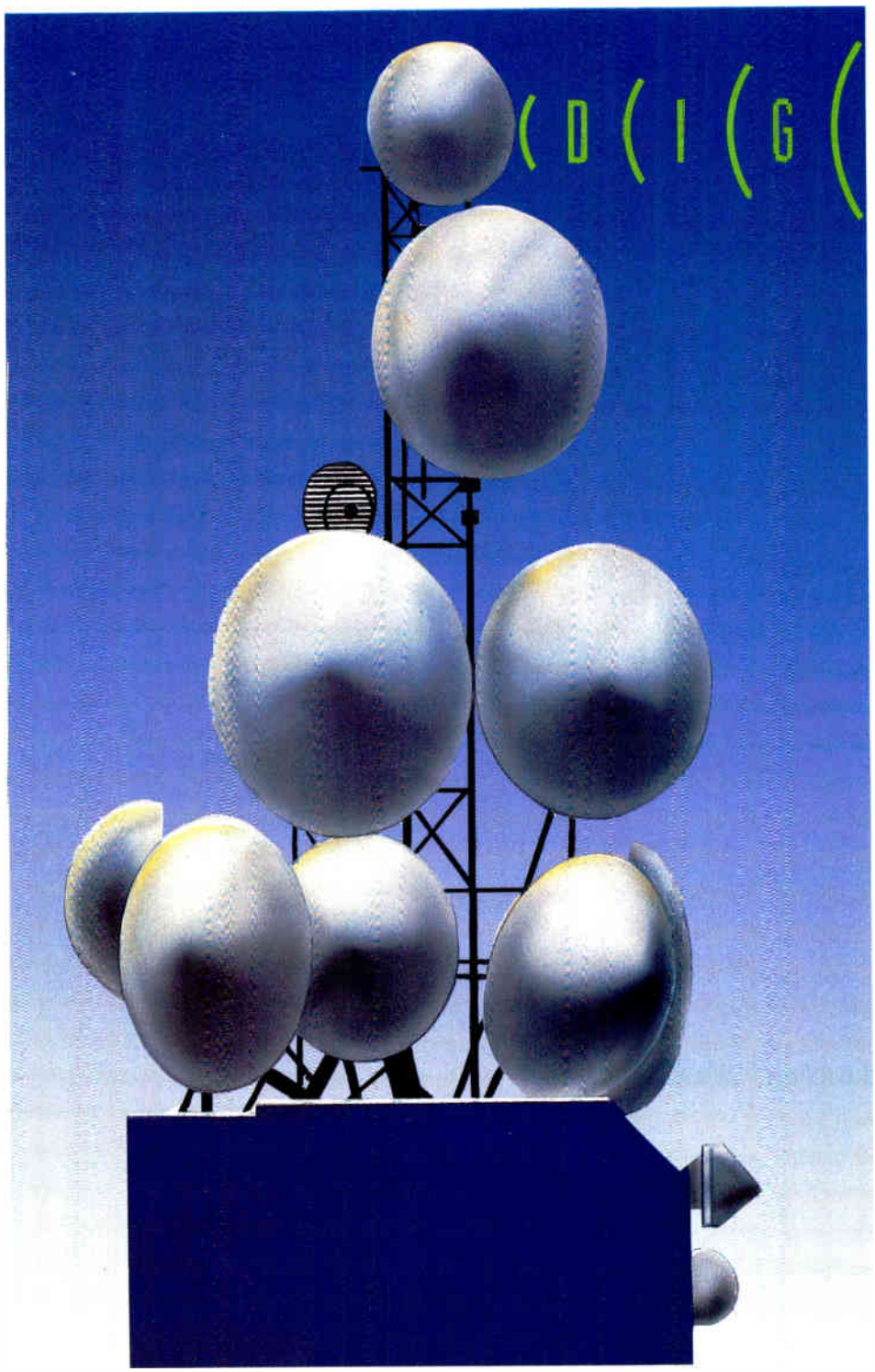

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Tutorial on signal leakage and calibration

Compliance via solid engineering tools

Editor's note: *Last summer, CED published a draft of the NCTA Recommended Practices for Measurements on Cable Television Systems, which was being revised to reflect the new technical standards imposed by the Federal Communications Commission. That document was not meant to serve as a tutorial on testing procedures, but instead was a discussion of the specific Rules adopted by the FCC. This month, we kick off a series of articles that focus on specific test parameters and more fully explain how they are performed.*

By Gregg Rodgers, Instrument Engineering Manager, Trilithic Inc.

In this article, leakage will be examined from several perspectives. First, the FCC Rules regarding leakage will be reviewed, then terminology and computations that relate to leakage measurements will be covered. Next, several alternative types of equipment for making leakage measurements will be discussed, followed by a simple test procedure that can be used to check the calibration of leakage gear.

First, a review the Rules is needed. Part 76.605(a)(14) of the Rules requires that leakage from a cable system be limited to no more than 15 microvolts per meter (μV/m) when measured 30 meters from the leakage source for frequencies below 54 MHz and above 216 MHz. It also specifies a maximum of 20 μV/m measured at a distance of 3 meters for all leaks between 54 MHz and 216 MHz. The Rules also describe the method for making leakage measurements using a resonant half wave dipole and a field strength meter.

General measurement method

In the recommended procedure, the dipole is moved along parallel to the cable system in the vicinity of a leak until the strongest signal is found. With the dipole held 3 meters above the ground and positioned the correct distance from the leak (see Figure 1), the dipole is then rotated in the horizontal plane until the maximum reading is observed.

For readings taken at 3 meters, the Rules specify placing the dipole directly below the leak. At times, however, it may be impossible to maintain the correct spacing. In situations like this, it is permissible to move the antenna to the side of the cable so that proper separations can be maintained.

Testing at 30 meters is accomplished in a similar way with the dipole spaced 30 meters from the system. In actual practice it is often easier to make all measurements at the 3 meter spacing and then estimate the level at 30 meters by dividing the 3 meter reading by 10. This kind of estimate tends to give worst-case levels so that actual measurements at 30 meters should only be necessary when the estimated signal exceeds 15 μV/m.

Understanding μV/m and antenna factor

Before discussing the equipment used to make leakage measurements, let's take a moment to understand the electrical terms. In the Rules, the maximum leakage limits are stated in μV/m. To understand the term μV/m (microvolts per meter), it is helpful to begin with an understanding of radiated power, or more properly, the power density of a radiated signal.

Think of power density as the amount of RF power contained in a marked off square of space (see Figure 2). In our case, it's a square meter of space. Capturing all of the power available in this space would yield the power density in watts per square meter (w/m2). CATV leakage levels produce very small power densities, so

Figure 1

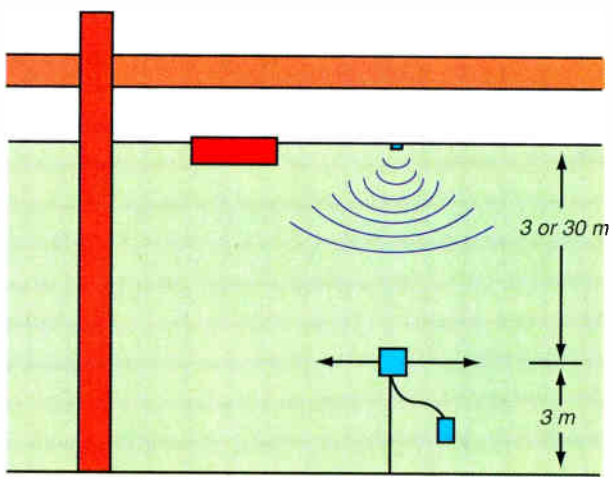
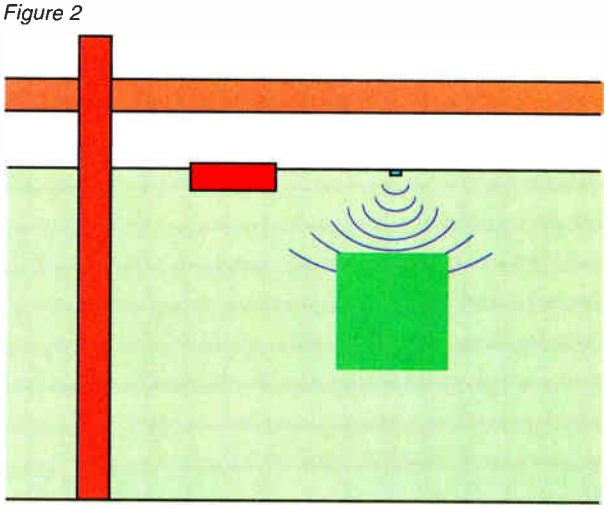


Figure 2



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Avoiding accidents on the info highway

RTK focuses on safety training

By Andy Booz

Strands of fiber and caoxial cable interconnecting televisions, computers, telephones and faxes coast to coast ultimately will form the link that delivers vast stores of information to America's front doorstep. Connecting homes and businesses to the Information Superhighway, when it materializes, will become part of the broadened responsibility of today's cable TV installers.

At least one of the nation's cable installation contractors is visualizing that future and doing something about it. RTK Corporation of New Providence, N.J. expects to guard workers against injury, teach the latest cable technology, and promote professional conduct through ongoing instruction. The approach is completely hands-on, featuring classroom instruction and follow-up job-site coaching.

In its 22 years, RTK has become the country's largest drop installation contractor. But during the late 1980s, cable operators began to feel the threat of tightening government regulation, and became concerned with how the public perceived them. Those cable operators looked to cable installation contractors to help minimize workplace dangers.

Earl Bennett, now RTK's training and safety manager, remembers those changing times–and what led to the creation of RTK's training initiative, known as the Qualified and Competent Installer Program.

"If a contractor has an accident while working on a TCI system, for instance, whose name is going to be in the paper the next morning?–TCI's," says Bennett. "So TCI began to worry more about the bad publicity generated by a story on some guy who gets plowed over by a car because his ladder was in the middle of the street without cones or his truck acting as a barrier.

Two trainees practice installing aerial drops at RTK's Northeast Region Training Center.

"The cable operators that hired RTK wanted contract installers that had a more professional attitude, and who worked safer. So in the early 1990s, as the cable business was changing, we realized it was time for RTK to change," Bennett says.

With a background as a CATV field installer and technical/safety trainer, Bennett joined RTK to effect that change. "Because RTK dealt with subcontractors, we were unable to have the kind of control we needed over our employees to mandate safety regulations, and do the job to the professional standards that we were seeking," says Bennett. "So we took all our subcontractors, despite whatever system they worked for, and made them RTK employees."

That meant RTK began shouldering the cost of subcontractors' worker's compensation insurance and general liability insurance–and began treating them as company employees. That move led not only to tighter control for RTK, but heightened installer safety standards and professionalism.

The bad news

It also brought some problems: It removed subcontractor employee incentives to return to work quickly because RTK was paying their worker's comp claims, greatly escalating the company's insurance premiums.

Before then, RTK had no clear method to trace the number and severity of subcontractor accidents. When one of its employees was hurt at work, if the subcontractor was incorporated and if the injury was serious enough, the business often went bankrupt.

"We heard about accidents, but RTK didn't track accidents," Bennett says. "Before, the motivation for subcontractors was for them to get back to work quickly (after a debilitating accident). But that incentive disappeared when an employee knows he's covered under RTK's worker's comp insurance because he knows he has another paycheck coming and a job waiting for him. So the shift away from piecework payment changed the way we did business."

The development of RTK's safety and training program extends beyond seeking the bottom line–the need to slash worker's compensation insurance premiums. Before deregulation of the cable television industry, subcontractors were driven by an entrepreneurial spirit to focus on the quantity of completed installs. With deregulation, cable operators expected installers to concentrate more on quality workmanship and professionalism.

Because installers were often the only personal contact with customers, cable companies put stock in those quasi-representatives. If they were to arrive on a customer's doorstep unshaven, unkempt and out of uniform, that would deal a blow to the company image.

During pre-regulation, Bennett says subcontractors earned more money when they worked harder. But quality was lacking. "We would just blow into a town, do as much work as we could until a cable contractor got sick of us, they'd fire us, and we'd go on to the next job," he says.

So along with other profound influences deregulation had on the industry, it tempered cable installers' entrepreneurial spirit–and many operating companies changed the way they compensated installers to pay-for-piecework. Installers found the change cutting into their paychecks. Stemming in part from RTK's new business direction, the company lost quality installers, sometimes entire crews, Bennett says. RTK remained steadfast, realizing its future competitiveness rested on a contractor having control over its employees. As telephone companies get more involved in cable through the evolution of the Information Superhighway, Bennett expects them to undergo the same evolutionary process.

Safety issues

In 1992, RTK's three majority owners–Roy Tartaglia (CEO), Rick Thomas (COO) and George Fenwick (executive VP)–recognized how the escalating safety problems and accident rates RTK experienced in 1992 was affecting the company's bottom line. And they realized they had to do something about it.

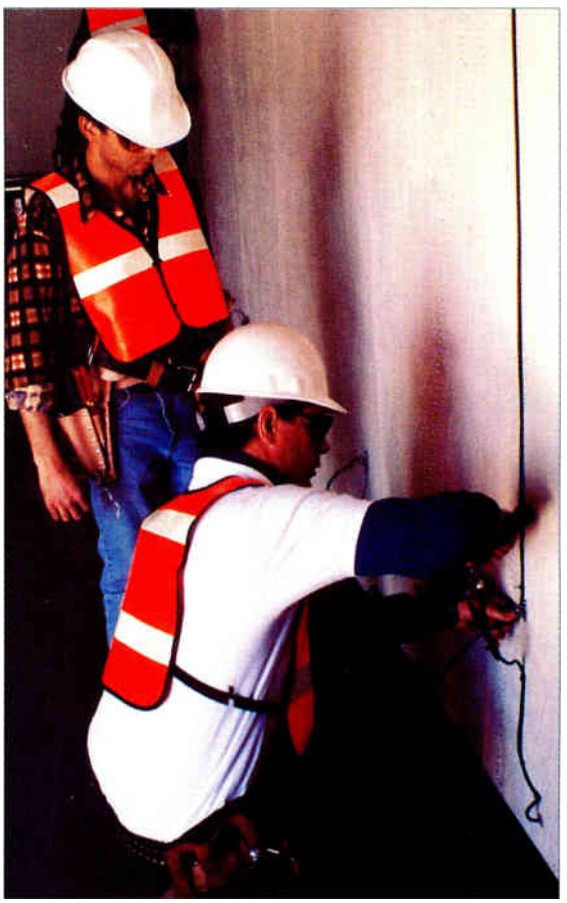
When Bennett was hired, he knew that the key to operating a safety and training program requires a constant sales job on the top-level managers. He succeeded in convincing RTK's executive board that getting the program rolling would mean a drastic change for the company. "I got the commitment up front that they would invest enough in safety and training to get the job done."

That commitment began with a $500,000 safety and training budget. Within six months, RTK executive staff had produced a mission statement that committed the corporation to being the country's "finest drop installation contractor." To that end, it counted on "cultivating the highest level of professionalism, quality of workmanship, job satisfaction and safe work practices."

As Bennett quickly realized, "A training program will surely fail if it's not aligned with a company's vision or mission. To develop a training program in name simply wouldn't succeed."

Bennett says creating an RTK mission statement was a critical first step to its remaining, and continuing to be, an industry pacesetter. "We realized that the cable television industry wasn't going to remain the same, that it was quickly evolving toward telecommunications. And as a company, we had to position ourselves not just to be a cable television contractor, but to service any of these telecommunications industries into the 21st century. We wanted to set the standard for other contractors, and have them look to RTK for setting trends."

An aggressive training program allows RTK employees to perform their jobs better than other contractors and know what it takes to adapt to the industry's direction, Bennett says. "When we start running phone and television lines into a house, that means we'll have to change the thinking of every installer in the field to this idea of not just bringing the signal to the television set, but of sending telephone signals back through the same line to the telecommunications system." One of the training program's primary objectives is preparing RTK employees for that technological progression.



John Brouthers, RTK Northeast Region training and safety coordinator, demonstrates how to install a ground block.

"By targeting RTK's new employees–by bringing them into a classroom for a week, and teaching them about cable, the history of cable, and how to do the job quickly and safely–we were essentially starting from the organization's lowest level," Bennett notes. This allowed the company to teach from the bottom up, and let the new employees influence the existing workers. "We're now almost at the second step, certifying our existing employees."

RTK's safety and training program faces the paradoxical challenge of striving to remain competitive while operating on an uneven playing field. But because it's setting higher standards of excellence, Bennett expects RTK to be recognized for that difference.

"One of dilemmas I face is not impacting production. Take, for instance, a guy who's used to completing 12 or 13 installs a day. Then tell him he's going to spend a day in class. It's a lot easier to convince a new-hire to do that. When we go over the mission statement, we tell them that if they find themselves in an unsafe situation, it's all right to make a judgment call, phone us and let us know what the problem is. We don't want them getting hurt out there."

To prove the point, RTK instructs installers who find problems, hot grounds for example, to contact their supervisor for advice on how to proceed, instead of making an assumption that could get them hurt. The company also leads by example; during the frigid temperatures suffered on the East Coast this past winter, RTK chose to shut down jobs because the ice was too thick to put up a ladder safely.

"We can't force our guys to just do whatever it takes to get the job done, because it might cost us more in the longer run," Bennett says. "And we realize now, that in some cases it does. Safety is the new driving force in our business."

To facilitate that attitude shift, RTK has each of its systems hold a mandatory safety meeting each month, typically held on a pick-up tailgate or around the warehouse. Bennett's office guides the discussion by assigning a safety topic for each meeting, and encourages crew members to express their concerns related to that issue. "This is one way for employees to know that we care about them."

When employees speak up and are heard at safety meetings, they consequently buy into

the program. And by enforcing the program, they recognize that RTK means business. "If you don't push employees to work safely, they won't,":Bennett says. "Companies can buy all the equipment they want, and conduct all the meetings they want, but if they don't enforce safety, it won't happen," Bennett says.

Installer orientation workshops rely heavily on a hands-on approach. Conducted by training and safety coordinators, the courses review and practice proper ladder handling, aerial drops, tone generator use, grounding, and connecting to a customer's equipment. In fact, installers must pass a "final exam" to demonstrate their new skills before they graduate.

"During our final exam, you might have some of our guys working with the tone generators, maybe some working outside with the ladders. Ladders are our biggest source of accidents, because guys will use them to cut a corner. If you don't set up a ladder properly, you're asking for trouble." Bennett says ladder problems include basic carelessness, not having the ladder set on a proper footing, hanging onto a strand of wire and hoping the ladder won't move, and others.

"One of the first things I did when I started with RTK was look at a loss-run of about five cases of eye injuries. I asked if the guys had safety glasses. I was told they weren't a mandatory safety item. Yet installers working in trees were being poked in the eye; and installers were being hit in the eye with the center conductor of coaxial cables." Shortly thereafter, RTK employees were instructed to wear safety glasses whenever hammering, chipping, or using power tools.

Before RTK's installer orientation workshops were started, field training was the only training.

"New employees would go out with an experienced installer, and learn all the bad habits of the experienced installer," Bennett says. "Now we're taking employees into the classroom teaching them all this good information, company standards and policies."

Once newly hired employees complete classroom training, "cable coaches" stationed on each crew serve as mentors, providing tailored instruction on the specifics of each cable system. Inspired by a higher wage, the coaches are selected for their exceptional skills and professional conduct, and must have successfully completed the Society of Cable Television Engineers' installer certification program.

Follow-up

Months after each installer orientation workshop, RTK's safety and training coordinators tour field worksites to ensure that installers are still practicing their classroom skills. "It's one thing to say they got the training program, but it's quite another to say they are using the program six or 10 months down the road," says Bennett. "That possibly involves counseling or coaching on the job site. We're checking on them, monitoring their progress–but it's not an adversarial relationship. We don't want our installers to think that we're out there as cable police. We just want to make sure that they're doing good, quality work and doing it safely."

Now past its inaugural year, Bennett's biggest challenge is spreading the safety and training message throughout the organization, particularly to existing employees. He also plans this year to equip all RTK employees with a Qualified and Competent Installer Program manual, whether they have taken the course or not. Also in the works for 1994 are written exams on the system and practical exams to RTK's 425 installers.

"The safety and training department now is functioning as a team that's bringing RTK together as a team."

That, too, will present Bennett's program with a particular challenge. While a new hire typically approaches work without preconceived ideas about how to do a job, existing employees generally do. While a new installer's thinking can be easily molded, Bennett says, an experienced installer "has months or years of bad habits and preconceived ideas" surrounding cable installation. "So you get some resistance. With most field employees, you typically get a buy-in; there's no balking about it.

"Now, when the time passes without a safety meeting, they ask what happened and what's the next discussion topic. Field supervisors are a bit more resistant, probably because they have been told all along to run their systems lean and mean, to spend as little money and get as much as possible. For that reason, safety training was perceived as wasted dollars.

"I had to change that whole idea–by teaching them how safety can affect their bottom line, how they can motivate their employees to do the job more safely, what worker's compensation costs, and how to fit safety and training into their work day. So getting supervisors to buy into the program is critical to making the program work."

How, and when, is it fair to judge the effectiveness of RTK's training and safety program? With the drop in the number and severity of accidents, worker's compensation premiums likely will decrease. But not right away.

Now just a year into RTK's program, the corporation's worker's compensation rates haven't responded to the wholesale changes brought on by its setting safety and training as a priority. In fact, its worker's comp premiums may not reflect the company's improved safety record for as long as five years, Bennett said. One of the signals of change insurance companies eye is an organization's "experience modification factor," a sample of its safety trend during the previous three years, he says.

A more immediate shift has been in employee morale. "The safety and training department now is functioning as a team that's bringing RTK together as a team. If we're completing plenty of installations but our people are getting hurt, it's hurting the bottom line. Training and safety is a way of getting information down to the field employee–and, in the process, showing him that we care, which is a whole new concept. That's been another wholesale change that's altered our company's way of doing business."

Reaction to that wholesale change from outside of RTK so far has been positive.

"Some of the contractors and cable operators view this as an aggressive move. It takes a company with $22 million in sales, such as RTK, to do something like this, because training costs money. Smaller contracting firms just don't have the money to take a similar approach, of having installers in a classroom for a day. Instead, they'd rather have them out installing cable. Yet that's the reason our training works: The time spent on hands-on classroom instruction ultimately pays off in the quality of our installs and the professionalism of our work."

That time investment's worth likely will reveal itself as the Information Superhighway draws closer to completion. At least one of the nation's cable installation contractors is ensuring its workhorse enters that new age with foresight.

In the words of an old Chinese proverb, "By nature all men are alike, but by education widely different." CED

Mr. Booz is a Denver-based freelance writer.

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What resulted is a broad discussion of the compliance issue, allowing the desired combination of precision, minimum service disruption, and resource allocation to be achieved. It is not a "how-to" manual. It does not replace other lawful compliance procedures imposed by enforcement agents of the FCC, or alternatives of a franchise authority. The reader is assumed to be experienced in the cable television industry, and to have knowledge of equipment calibration requirements and procedures.

Future revision will occur with changes in the Rules, technology or operating practice. The NCTA Office of Science and Technology updates the registered owners of the Recommended Practices manuals. For further information, check with the NCTA, the FCC, or your company counsel.

– Dan Pike, Prime Cable, Subcommittee chair

values would most likely be expressed in microwatts per square meter ($\mu W/m^2$).

Building on the concept of power density, let's move on to examine how electric field strength is related to power density. Remember that power can be expressed in terms of voltage and resistance. Since we are talking about power density (W/m^2), it is reasonable to expect that the electric field strength would also contain meters in its units of measure as well. Volts per meter ($\mu V/m$ in our case) are the units that result from solving the power equation for the electric field. The electric field strength is related to the power density by the familiar equation for power (see Equations 1 and 2).

$$P = \frac{E^2}{R} \qquad (1)$$

Solving for E (the electric field strength)

$$E = \sqrt{PR} \qquad (2)$$

where R = 377 ohms (the impedance of free space)

To see where $\mu V/m$ comes from, let's work on the units only beginning with the units for watts (see Example 1, below).

$$\text{watts} = \frac{\text{volts}^2}{\text{ohms}}$$

Therefore:

$$P_{(\text{density})} = \frac{\left[\frac{\text{volts}^2}{\text{ohms}}\right]}{\text{meter}^2}$$

Example 1

Now from equation (2):

$$E = \sqrt{\frac{\left[\frac{\text{volts}^2}{\text{ohms}}\right]}{\text{meter}^2}} \times \text{ohms} = \frac{\text{volts}}{\text{meter}}$$

Dipole antennas

Now let's turn from the discussion of electric fields to the means by which these fields can be turned into a voltage that can be measured. The most commonly used method in the CATV frequency range, and the one recommended in the Rules, is the use of a dipole antenna. The dipole offers the advantages of reasonable size, simple construction and repeatable results.

The dipole also has a feed point impedance of about 73 ohms which makes it a natural for interfacing with cable test equipment. Dipoles are balanced antennas however, so a balun (balanced to unbalanced) transformer is required when connecting a dipole to coaxial cable. Some dipoles may also contain an impedance transformer to match them to 50 ohm coax.

Table 1

Channel	Frequency (MHz)	Dipole length (in)	Antenna factor (dB) 50 ohm	75 ohm
2	55.25	101.5	2.9	1.2
4	67.25	83.4	4.7	2.9
6	83.25	67.4	6.5	4.7
14	121.25	46.3	9.8	8.0
15	127.25	44.1	10.2	8.4
16	133.25	42.1	10.6	8.8
17	139.25	40.3	11.0	9.2
18	145.25	38.6	11.3	9.6
8	181.25	31.0	13.3	11.5
10	193.25	29.0	13.8	12.0
12	205.25	27.3	14.3	12.6

Before a dipole is used to make calibrated measurements, it is necessary to adjust its elements for resonance. A properly adjusted dipole will have an overall length slightly shorter than a half wavelength in free space because the effective length of its elements are a function of the ratio of their diameter to their length. The larger the diameter of the elements, the shorter the antenna will be at resonance. For typical dipoles used to make cable measurements, the overall length is given in Equation 3.

$$\text{overall length (in)} = \frac{5610}{f_{(\text{MHz})}} \qquad (3)$$

Note: When adjusting a dipole for resonance, always make the elements equal in length.

Another important property to understand about antennas is Antenna Factor (AF). Antenna Factor relates the antenna's ability to turn a given field in $\mu V/m$ into an equal number of microvolts at it's output terminals. Antenna Factor is a function of frequency and the gain of the antenna. AF is also dependent on the output impedance of the antenna. In general, the higher in frequency the antenna is used the lower the output voltage will be for a given field strength. The AF for 50 and 75 ohm dipoles is derived by Equations 4 and 5.

50 ohm AF = .0254 f (MHz) or 20 log .0254 (MHz) dB (4)

75 ohm AF = .0207 f (MHz) or 20 log .0207 f (MHz) dB (5)

Table 1 gives some representative values for dipole dimensions and antenna factor.

With the dipole set to the proper length and the AF determined, it's time to look at how readings made with a dipole relate to the field strength. If the measur-

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ing equipment is calibrated in microvolts, Equations 6 and 7 are used.

$$E = 0.0207\ fV \text{ (75 ohms)} \quad (6)$$

$$E = 0.0254\ fV \text{ (50 ohms)} \quad (7)$$

Where

E = field strength in μV/m
f = frequency in megahertz
V = reading in microvolts

Note: these equations do not account for loss in the coax. For losses up to 1 dB, increase the field strength by 1 percent per 0.1 dB of cable loss.

For equipment calibrated in dBmV, see Equations 8, 9 and 10.

$$V(dBmV) = 20 \log E(\mu V/m) + G - AF - 60 - L \quad (8)$$

or

$$E(\mu v/m) = 10^{\left[\frac{V(dBmV) + AF + 60 - G + L}{20}\right]} \quad (9)$$

Equation (9) can be rewritten in more familiar terms as:

$$E(\mu v/m) = 20.7 f_{(MHz)} \times LOG^{-1}\left[\frac{dBmV - G + L}{20}\right] \quad (10)$$

Where:

V(dBmV) = reading in dBmV
E(μV/m) = field strength in μV/m
G = gain of preamp in dB (if required)
AF = antenna factor in dB
L = cable loss in dB

Measurement with an SLM or spectrum analyzer

The other essential piece of equipment needed to make leakage measurements is a calibrated receiver. There are several possible choices, but the most popular devices are signal level meters, spectrum analyzers and designed to purpose leakage receivers. With proper technique, each of these devices is capable of making accurate measurements. Techniques for the use of each is given in succeeding paragraphs.

Testing with a signal level meter should proceed as follows. First select the cable channel or leakage carrier to be measured. Remember that SLMs have rather wide IF bandwidths, so select a frequency that is free of nearby over-the-air signals. When selecting a channel in the air navigation band, be sure to check on the frequencies used by local airports. Strong signals even several hundred kilohertz away could obscure measurement of leakage signals.

Once the monitoring frequency or frequencies have been determined, use Equation 8 to determine the expected antenna output in dBmV. In many cases, this will be at or beyond the sensitivity limits of the SLM. To extend the SLM's range, a preamp may be inserted between the antenna and SLM. A preamp with 20 dB gain and 10 dB noise figure is usually adequate.

Next, set the SLM to the desired frequency. If the SLM is not digitally tuned (synthesizer controlled), set the dial carefully at a system test point prior to making measurements. Use Equation 9 to convert SLM readings to μV/m.

Using a spectrum analyzer is similar to using an SLM. The same precautions apply to selecting a measurement frequency. Analyzers usually have narrower IF bandwidth selections than SLMs, making adjacent signal separation less stringent. But, be aware that narrowing the IF bandwidth beyond a certain point will affect the ability to measure the vertical sync peak of a video carrier. Also be aware that some forms of scrambling suppress the vertical sync peak.

To determine which IF bandwidth to use, connect the analyzer to a system test point and tune to the desired leakage carrier. Start with an IF bandwidth of 100 kHz or more and note the peak of the vertical blanking interval. Reduce the IF bandwidth until the peak is no longer at the reference level. Use the narrowest IF bandwidth available that does not reduce the peak level. As with the SLM, use Equation 8 to determine whether a preamp is needed.

Caution: Broadband preamps and spectrum analyzers or SLMs that have broadband front ends can be subject to intermodulation distortions from strong off-air signals. If intermod is suspected, compare the readings before and after inserting a 3 dB pad at the antenna output. If the reading changes by more than 3 dB, intermod is indicated. Inserting a low loss bandpass filter at the antenna output will often cure an intermod problem. Be sure to include the filter's loss with the antenna's drop lead loss when figuring leakage levels.

Testing with leakage receivers

Calibrated leakage receivers provide all of the characteristics needed to make leakage measurements in a single, low-cost package. They have high sensitivity which eliminates the need for preamps and narrow IF bandwidths that offer better adjacent signal rejection than SLMs. Built-in RF bandpass filters reduce the possibility of intermodulation problems. Most models have readouts calibrated in μV/m that automatically compensate for antenna factor and coax loss.

So all that remains is to grab a dipole and go. Right? Well, not exactly. There are two additional considerations that need attention. Both are related to the narrow IF bandwidth. First, the narrow IF does not eliminate the need to worry about signals close to the measurement frequency. In the air navigation band, an interfering signal could be as little as 12.5 kHz away. Check your leakage receiver specs and make sure that adjacent signals are 3 to 5 IF bandwidths away.

Second, the narrow IF bandwidth can cause errors in reading the peak of a video carrier, particularly when some of the more sophisticated scrambling techniques are used. Most receivers which do not use dedicated carriers are calibrated for standard NTSC so, if at all possible, use an unscrambled channel. With the IF bandwidth considerations properly taken into account, now it's time to plug in that dipole and get going.


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Checking calibration

The last topic we'll discuss is how to check the calibration of leakage equipment. The following procedure is primarily intended for leakage receivers but is also useful for checking SLM or analyzer set-ups that include preamps and/or filters. It also has the advantage of using the actual leakage carrier so that effects of IF bandwidth or detector response are taken into account.

The first step is to determine the test levels in dBmV for each frequency and leakage level to be checked. The objective is to set a level at the variable attenuator's output equal to the expected output from a dipole placed in a field equal to the chosen test levels. Use Equation 5 or Table 1 to determine the AF for a 75 ohm dipole (compensation for 50 ohm units will come later). Then use Equation 11 to determine the antenna output in dBmV.

$$V(dBmV) = 2\text{- log } E(\mu V/m) - AF - 60 \qquad (11)$$

Note that this equation is similar to Equation 8 with the G and L terms eliminated. If the preamp and or down lead cannot be included in the test set-up, include the proper term per Equation 8.

Tip: Calculate only the value for 200 µV/m and figure the other levels remembering that 6 dB changes in attenuation will increase or decrease voltage by a factor of 2 and 20 dB will change the voltage by a factor of 10.

If your leakage receiver has a 50 ohm input impedance it will be necessary to use a matching pad or transformer. Increase the level found in Equation 10 to account for the loss of the matching pad. The typical

Table 2

Channel	Dipole output (dBmV) 50 ohm Resistive Match (5.7 dB)	50 ohm Transformer Match (0.1 dB)	75 ohm
2	-9.4	-15.0	-15.1
4	-11.2	-16.8	-16.9
6	-13.0	-18.6	-18.7
14	-16.3	-21.9	-22.0
15	-16.7	-22.3	-22.4
16	-17.1	-22.7	-22.8
17	-17.5	-23.1	-23.2
18	-17.8	-23.4	-23.5
8	-19.8	-25.4	-25.5
10	-20.3	-25.9	-26.0
12	-20.8	-26.4	-26.5

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former matching networks are usually very low loss, on the order of 0.1 to 0.2 dB. Table 2 gives some typical values for 200 µV/m.

Connect the equipment as shown in Figure 3 or Figure 4. It is a good idea to check for leakage around the test location as strong leaks could get into the test equipment or wiring and give false readings at low test levels. Use an SLM or spectrum analyzer to set the level at the attenuator output to the value calculated for 200 µV/m. Accuracy is important here, so it's a good idea to check the SLM or analyzer against a calibrator.

When the appropriate test level is set, connect the receiving equipment to the test

Figure 3

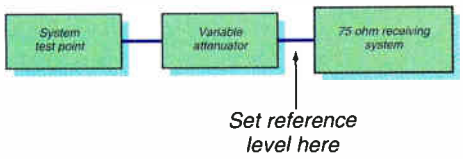
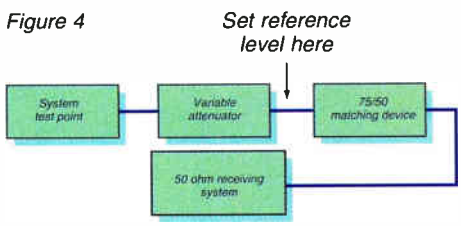


Figure 4



set. Remember to include the antenna down lead, preamp and or filter where appropriate. If an analyzer is used as the leakage receiver, be sure to set the correct IF bandwidth and turn off video filtering. Tune the receiver to the leakage frequency and note the reading. Adding 20 dB to the attenuator setting will give the test level for 20 µV/m. Add 20 more and get the level for 2 µV/m. Return the attenuator to the setting for 200 µV/m and add 6 dB to get the test level for 100 µV/m. Add 6 more to get 50 µV/m. And so on.

Using this procedure for the expected range of leakage levels, it is possible to make a calibration chart for your leakage equipment. There is also an added benefit for SLM/analyzer, preamp, filter users when performed with all elements in place, as it accounts for all of the gains/losses and their effects on system noise figure.With care, this procedure can be used to recalibrate leakage receivers.

Leakage has been the byword in the 1990s, but that may soon be changing. Digital compression and new modulation techniques like QAM may shift the real pressure from keeping signals *in* to keeping all those nasty terrestrial signals *out*. Happy hunting. CED

Network management for emerging broadband services

A two-pronged challenge

By Satish Desai and Mike DeMaio, AT&T Network Systems

A growing variety of customer requirements is fueling the evolution of communications networks to broadband systems that offer transmission rates of 45 megabits/second (Mbps) and above. Customers want reliable, high-quality broadband support for such advanced services as data, image-based communications, video and multimedia applications.

In response to these customer demands for proven business solutions, telecommunications network service providers are deploying more and more broadband capabilities throughout their networks. The intelligence built into these high-speed networks enables providers not only to satisfy customer requirements but also to do so more quickly and cost-effectively than before.

Smart network elements, by incorporating some element-management functions, permit service providers to shift their focus away from managing individual elements to managing entire networks and service sets.

That shift in focus, combined with the increasing complexity of networks made up of many interdependent elements from multiple vendors, demands an advanced approach to network management. It also demands a new approach to developing the software-driven network management applications.

Network-management challenges

Asynchronous Transfer Mode (ATM) is an important broadband technology which is gaining rapid, widespread acceptance within the telecommunications and data networking industries. ATM provides a new method for formatting, multiplexing, cross-connecting and switching information in 53-byte cells.

By combining the low-delay/delay-variation properties of circuit switching with the statistical multiplexing and bandwidth-variable properties of packet switching, ATM redefines how communications networks are implemented.

ATM enables the network to treat delay-sensitive and fixed-bandwidth traffic, such as voice communications, differently from highly variable traffic that is less sensitive to delay, such as data communications. Thus, the communications network can be "tuned" to allow different network applications to obtain different grades of service.

Smart network elements permit service providers to shift their focus to managing entire networks.

One major benefit of ATM-based networks is their ability to support a variety of services, running at diverse speeds, with a unified network infrastructure. Another benefit is the greater network utilization that comes from ATM's ability to statistically multiplex bursty, high-bit-rate traffic along with constant-bit-rate traffic such as voice communications.

Yet these benefits also confront service providers with greater network-management complexities. For example, with so much critical information riding on a common network, effective traffic management means that providers must minimize the impact of network problems. They must be able to monitor traffic in real time, re-route it when necessary and put controls in place until they can isolate and fix the problem.

Account management is another network-management application that becomes even more critical in a broadband environment. Billing practices will be quite complex because billing will be a function not of individual customers but of each service to which a customer subscribes. In addition, the broadband network will further complicate billing for variable-rate services. Providers must have the management tools to track and rate usage, as well as render bills, for each customer's mix of services.

Bandwidth on demand, a driving force in the evolution to broadband networks, also presents the need for effective configuration-management applications. Such tools will give service providers and customers alike the ability to control network configuration on a real-time or near-real-time basis.

Again, the fact that a common network infrastructure will be satisfying numerous, critical customer requirements magnifies the importance of fault- and performance-management applications. For the former, service providers not only need alarms and network event data from switching systems and transmission facilities; they also need integrated tools that can collect, consolidate, correlate and display the data, enabling them to detect, analyze and solve root causes of network problems.

To monitor network performance, service providers need tools that track overall network behavior to determine traffic peaks and circuit loads, as well as provide detailed network utilization reports.

Interoperability of applications

In today's fast-paced, highly competitive marketplace, service providers cannot afford to specify to each and every vendor the types of information that must be exchanged and the exchange protocols among diverse network-management applications. Nor can they afford the time and resources necessary to write their own specialized interfaces between competing vendors' applications.

They want applications that will work together, within one platform as well as across multiple platforms, to help them reduce costs and development time. This will impact other factors as well, and will help the providers improve service quality, ensure network reliability, maximize use of network resources, increase revenues, reduce training time and ultimately strengthen their ability to compete in the marketplace.

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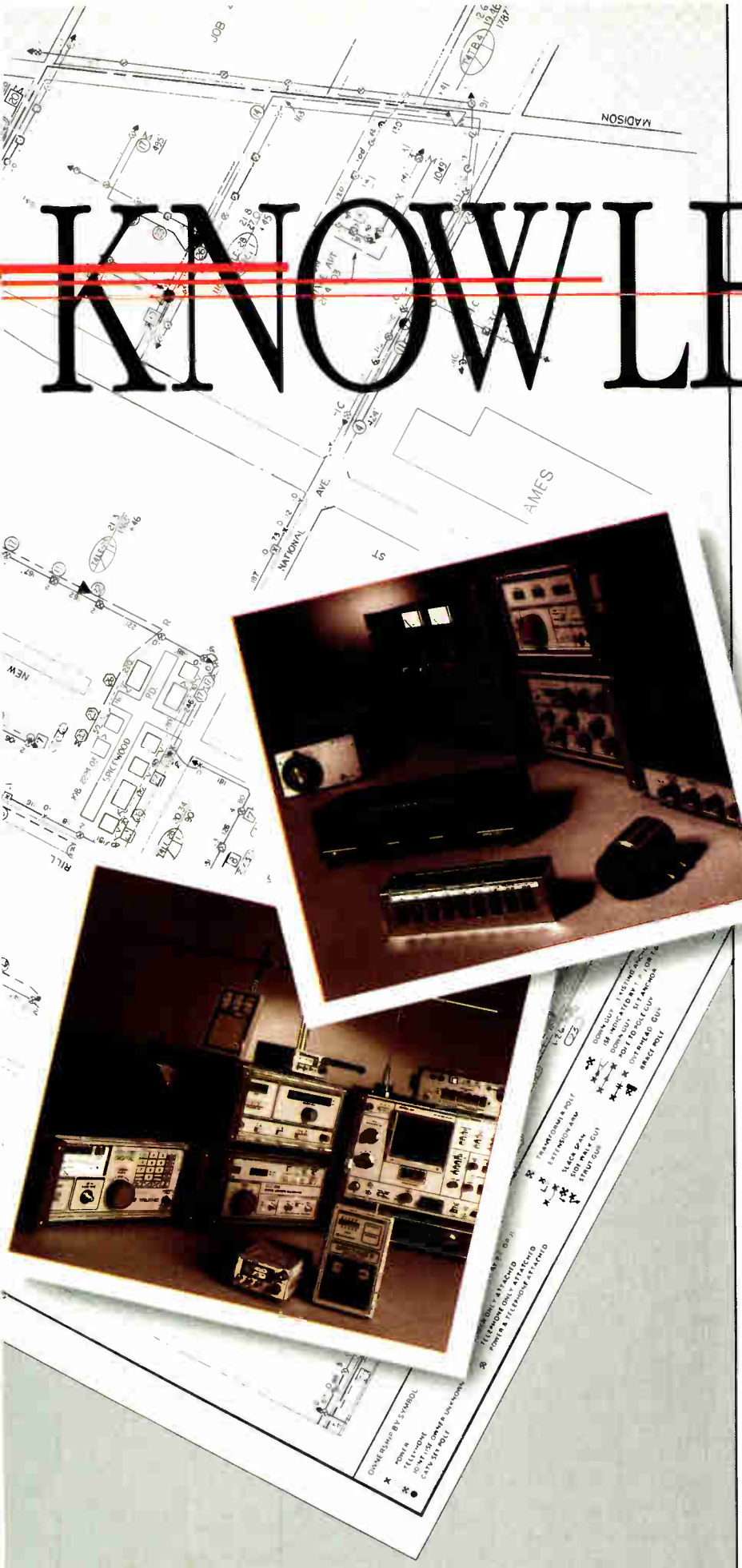

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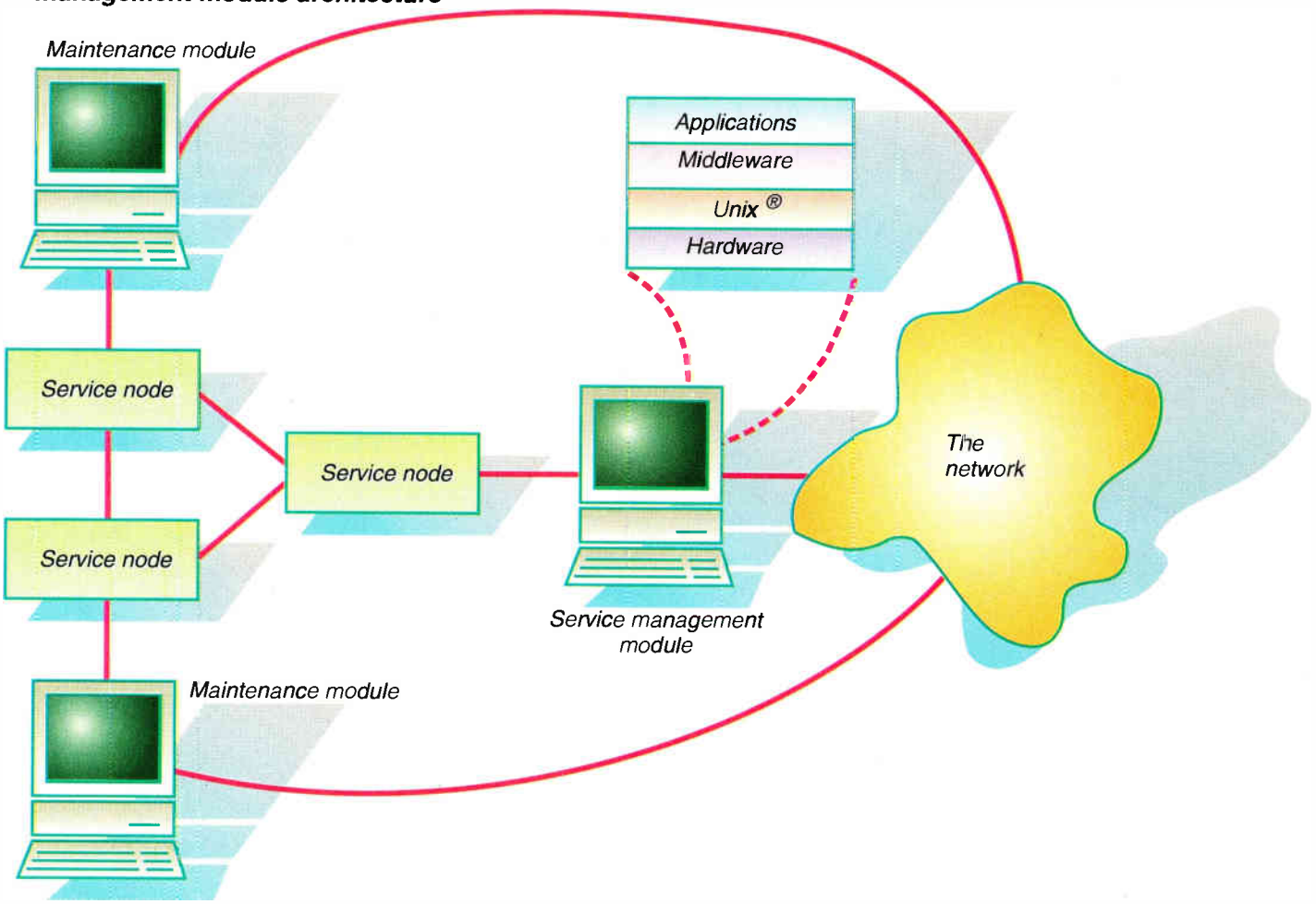


Only such a "plug-and-play" approach can give service providers the entire range of functionality they need: ready access to all the information necessary to detect and resolve problems quickly, reduction of service degradation and outages, more efficient traffic management and a boost in service delivery and assurance.

More and more vendors, rather than building proprietary, device-specific, network-management applications that often are designed for only one platform, are building their applications according to international standards. One of the most important is the Telecommunications Management Network (TMN) standard, defined by the International Telecommunications Union-Telecommunications Sector (formerly CCITT).

Vendor compliance with the TMN standards enhances the interoperability of diverse management applications. Two important network-management protocols are the Simple Network Management Protocol (SNMP) for interfaces between network-management systems and customer-premise equipment, and the Common Management Information Protocol (CMIP) for interfaces between the telecommunications network elements and the management applications, as well as between two management applications.

Object-oriented technology

To develop the more flexible network-management applications required for broadband operations, many service providers and their vendors are turning to object-oriented computing technology.

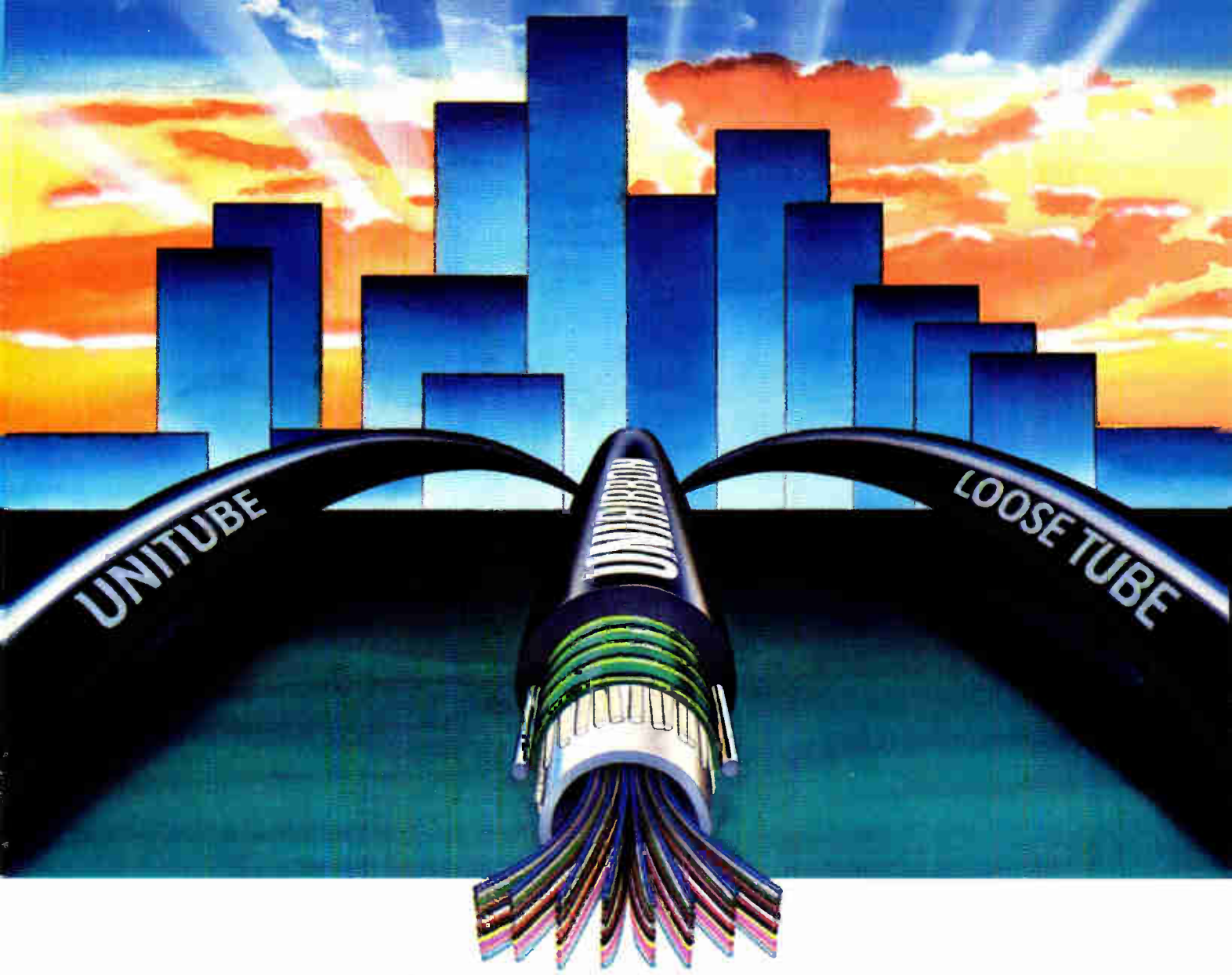
The integration of object-oriented technology with applications development offers a more "natural" programming paradigm than the traditional procedural paradigm because of its intuitive abstraction and encapsulation properties.

Software design based on TMN-compliant sets of objects and building blocks is critical to a service provider's ability to introduce new services rapidly and tailor them to individual customers' needs.

In addition, service providers can design and develop new network-management applications by reusing standard objects that are developed by several vendors, thus simplifying and expediting the task of integrating products supplied by multiple vendors.

Object-oriented technology simplifies application development by automating via software.

Object-oriented technology simplifies applications development by automating via software reuse many common but complex and error-prone tasks. Developers thus are free to focus on such higher-level, domain-specific tasks as network fault isolation. The result is



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A broadband management platform

In the evolving broadband environment, applications developers are under pressure to reduce the cost of developing network-management systems. Accordingly, they are looking for ways to shorten applications development cycles and to produce applications that can be customized, yet function in a multivendor network.

They also recognize that their service-provider customers, to meet their individual subscribers' requirements, must be able to support management applications on a variety of hardware platforms, network options, databases and user interfaces.

For their part, telecommunications service providers are looking for ways to reduce the costs of operating these network-management systems. They want a common set of administrative procedures to help reduce the cost of training personnel to operate these systems. In addition, they want network-management systems that can share resources with other applications and thus help them consolidate resources in operations centers.

To meet the network-management challenges created by the broadband evolution, telecommunications service providers and applications developers need a platform on which they can design, develop and run network-, service- and business-management applications. Such a standards-based platform should support the following capabilities:

✔ rapid, cost-effective development of applications;
✔ interoperability and sharing of data among applications;
✔ customization of applications to individual subscriber requirements;
✔ support tools for building customer-oriented network management, along with service provider control;
✔ support for hybrid networks and network-management applications, thus protecting embedded investments during migration to full broadband, open-systems operations; and
✔ support for both procedural and object-oriented technology during migration to a strictly object-oriented development environment.

Such a platform also should incorporate middleware–software positioned between applications and the operating system–to make it easier for developers to take advantage of new standards and technologies while reducing development time and costs.

In addition to providing an object-oriented application platform for development of standards-compliant applications, the platform should support procedural-based applications development. This enables service providers to migrate gradually from legacy applications to an open-systems environment.

To be as broadly useful as possible, the platform also should incorporate many of the industry-standard development technologies, including C++, X-Windows and relational database systems. Developers can select from a variety of database systems, graphical user interfaces and network and management protocols.

Models do exist

Models for the telecommunications industry do exist, however, which include the above-mentioned capabilities and features, and which also support four primary functional areas of a system: operations, administration and maintenance (OA&M); communications and networking; user interface; and database.

The ongoing evolution of the platform will include new standards and technologies as they evolve.

OA&M, the platform's core, manages all the other platform and application assets and, together with the communications services component, makes up the platform's "software backplane."

Given the similarities between providing application OA&M services for managing an application and telecom network-management OA&M, the system is organized around the OSI network-management functional categories, i.e., security, configuration, fault and performance management.

The communications services are designed to insulate applications from the underlying networks. This is intended to make system design and development easier, facilitate reuse and enable the applications to work over a variety of networks. The communications services provide general-purpose, object-to-object or application-to-application communications mechanisms.

These platforms support manager-agent, peer-to-peer and client-server communications paradigms and a range of communications services, such as a message-based service, a high-performance connectionless communications mechanism and a connectionless transaction-based service.

The user interface component typically consists of character-oriented and map- and form-oriented graphical interfaces, while the database services component permits interaction with commercial relational database-management systems.

Platforms also provide several development tools, including support for multiple national languages, provisioning and configuration tools and application generators. Figure 1 illustrates one such broadband network-management application

The ongoing evolution of the platform will include new standards and technologies as they evolve. Enhanced platforms will further simplify development of standards-compliant applications by providing standard object libraries, as well as common system-management functions required by numerous applications.

They also will likely include object-conformance test suites to provide an end-to-end development environment for standards-based, object-oriented applications.

To reduce the development cycle even more, some telecommunication service providers plan to automate more of the tasks still performed by developers, and will target greater portability and interoperability of management applications across a wide variety of hardware, operating systems and other middleware.

Summary

Telecommunications service providers today face a two-pronged challenge. Externally, in the increasingly competitive marketplace, they must be able to respond quickly to customer demands for advanced, high-quality services. Internally, they have to reduce their costs, improve operating efficiencies and protect their embedded technology investments while simultaneously migrating their networks to a broadband environment.

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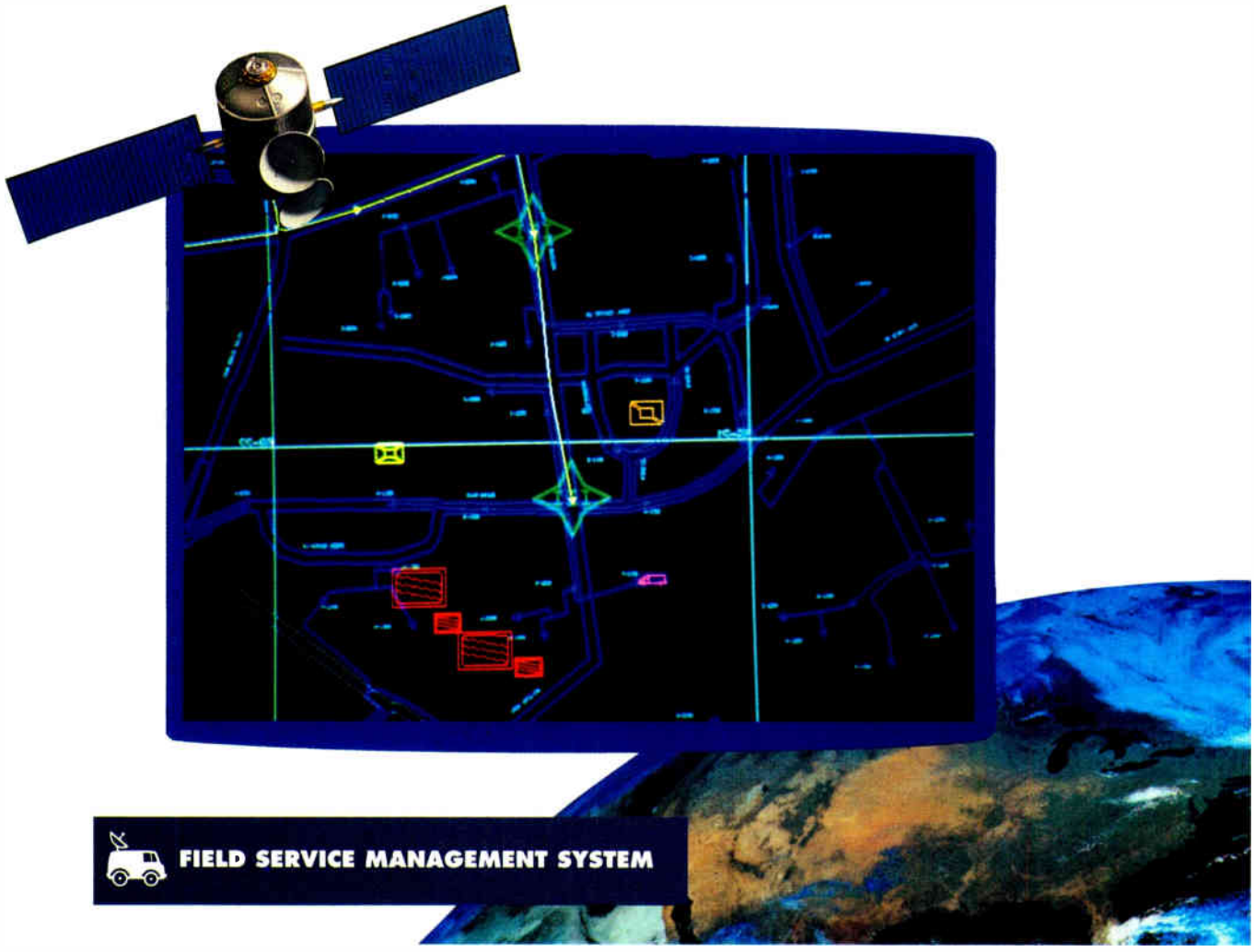

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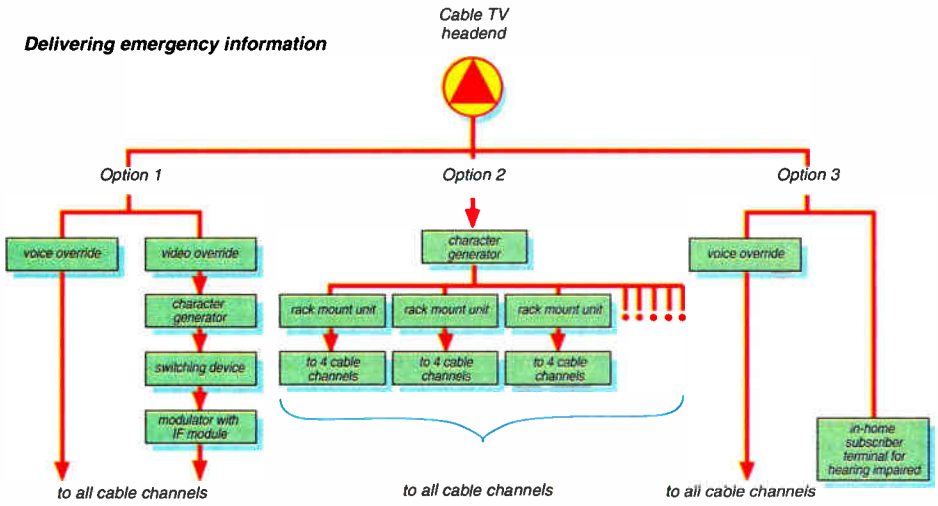
The new EBS: What it means for cable operators

Rules, equipment and strategies needed



By Jack Bryant, Vice President and General Manager, Interactive Systems, ANTEC; and Marty Callahan, President, HollyAnne Corp.

Since the beginning of time, mankind has faced disaster with little or no warning. The Emergency Broadcast System (EBS) was initially designed to help avert this problem. When it was established back in the 1950s, traditional radio and television broadcasters were required to provide the means to deliver national warnings to the public. However, because more people are now getting news and information from other sources, including cable television, the Federal Communications Commission is in the midst of issuing new rules that will bring EBS up to date.

EBS rules scheduled to be issued this month will both clarify the requirements and put new demands on cable television systems. The new mandates will state that the cable industry will–similar to broadcasters–become responsible for delivering national emergency information to the public.

Like broadcasters, cable systems will soon be required to own and operate the equipment needed to provide national emergency information via the cable television plant, from the reception of emergency signals at the headend through delivery of information to the subscriber. Cable systems will also need to periodically test their systems and pass along national warning information in the event of an emergency.

In addition, any EBS solution must provide both audio and visual information that meet the additional requirements of the Americans with Disabilities Act (ADA), which states that the disabled (primarily the deaf and blind) must have access to a source of the same information as the non-disabled.

Cable and the new EBS

Since its establishment, EBS information originated from Washington, D.C. and was disseminated to the public through a daisy chain of linked radio stations. Teletype machines were typically used to alert other area radio/television broadcasters of critical national information that could be quickly reported over the public airwaves. Key aspects of the original EBS ruling–much the same as the new rules bringing cable television into the fold–mandated that broadcasters own their own equipment, complete periodic tests of the system, and run warnings in the event of national disaster. (Local alerts, such as severe weather, were left to a broadcaster's discretion).

Four years ago, former President George Bush pushed for an update of the EBS system. Since then, EBS personnel have worked closely with the Society of Cable Television Engineers and other industry groups to determine just how cable systems could comply, should new EBS rules be adopted.

The SCTE maintains that cable systems are not in the same position to handle the EBS as broadcasters have traditionally done. The key difference, according to the SCTE, is that broadcasters originate their programming via one channel, while cable systems retransmit signals over multiple channels. Consequently, this makes cable television compliance to pending EBS legislation more complex and potentially costly. For cable television to comply, the SCTE submits, any new EBS system should be fully passive, because many cable headends are unattended.

Another of the SCTE's arguments–why force cable television systems to implement old technologies before new ones could be analyzed?–encouraged the EBS to persuade Congress to temporarily back down on the EBS aspect of the Cable Television Consumer Protection and Competition Act of 1992.

In Denver and Baltimore last year, the EBS conducted field trials of several enhanced emergency alerting systems to assist the Commission in improving operational and technical aspects of the EBS. These tests included an analysis of cable television's role in EBS delivery and resulted in the new rules that will be established.

Receiving emergency warnings

The first step for cable television systems to meet the new EBS rules lies in receiving information from emergency sources. Current technologies, such as those tested by the EBS last year, can handle this requirement. Several solutions tested by the EBSwere specifically developed for cable television systems.

In one such scenario, a headend controller unit which accommodates multiple inputs (including information from the Emergency Broadcast System, Federal Emergency Management Agency and local alerts emanating from the National Weather Service and local municipal authorities) can be used to drive various types of subscriber information delivery systems, including audio overrides, full-screen and text crawl feeds, and in-home subscriber terminals.

Much as the SCTE has stressed, EBS controller units should offer cable operators a completely passive system that requires no monitoring from cable television personnel. Once the system has been configured to deter-

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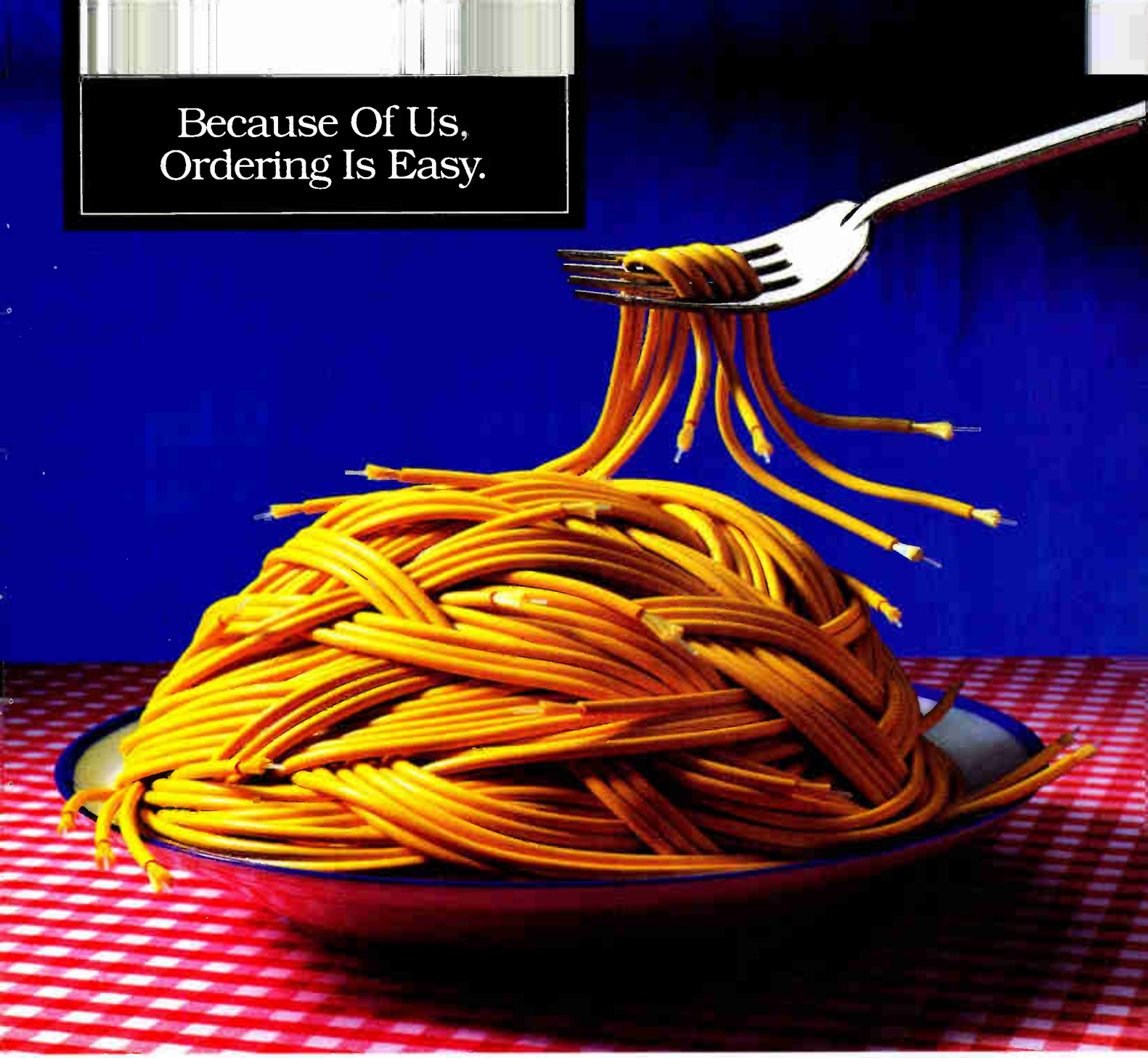

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mine alert priority levels, the controller unit monitors digital inputs sent from emergency information bureaus and can automatically send along information to related subscriber delivery equipment and, ultimately, to the subscriber.

Should a cable system elect to use a system for local alerts–a prospect that apparently will not be mandated by the new EBS rules–the controller can determine alert priorities, by skipping "watches" and issuing information only in the event of a "warning."

Once emergency information is received at the headend, subscribers must be alerted. The first potential solutions that meet the new EBS rules include two relatively easy-to-implement systems:

✔ A tone-voice override system that would block out audio over the complete cable television channel lineup. This capability would offer an emergency official the opportunity to issue a verbal warning, typically via a telephone line. In this instance, the voice would be "sprayed" out over all channels. The costs: $3,000 to $4,000, although some estimates suggest that up to 50 percent of cable systems may already have this type of equipment in place as a result of franchise agreements.

✔ A video override system that includes the audio override function would block out video signals for a full picture audio/visual message over all cable channels. This system utilizes a character generator and computer equipment that is hardwired to each channel. It requires a switching device and an additional intermediate frequency module in the modulators. Depending on the equipment selected, costs will be about $120 to $150 for a 40-channel system and approximately $85 to $100 for an 80-channel system.

The problems with these approaches are two-fold. First, cable systems will likely be reluctant to interrupt programming with a long verbal message and/or a full-screen text display for any purpose other than a national or major local disaster that impacts all subscribers. Secondly, complying with Americans with Disabilities Act (ADA) legislation means neither of the above solutions–working alone–will suffice in providing emergency information for the disabled.

Text crawl with audio

Text crawls with audio override capabilities are a bit more complex. The controller can be wired to existing character generators to provide the audio override via the voice storage capability. A tone first alerts subscribers, followed by the voice information. A text crawl developed from the incoming digital information then provides visual information.

This combination audio/visual override system requires–along with the headend unit accepting incoming emergency information–additional rack-mounted units capable of passing the voice and digital text information to each channel on the cable system. Currently, one unit of this type of equipment can only accommodate four individual channels. In the case of a 50-channel system, that equates to an additional 16 pieces of individual equipment, all manually patched together from the character generator and through a combiner for emergency information transmission via each channel.

The costs?

SCTE EBS Committee chairman Ken Wright told MultiChannel News the combined costs of video override, audio override and dedicated hardware could run as high as $50,000 per cable headend (or in other words, a 60-channel system would incur costs of over $800 per channel). Wright added that this per-headend cost would constitute an unbearable economic impact on small and rural operations serving half the nation's cable subscribers.

A second concern with this solution arises with the future delivery of signals. How can the text crawl and voice override system be placed on

compressed channels that may be delivered from the satellite via cable directly to the set-top?

A third problem again relates to the ADA. Any text crawls must be raised above the area traditionally allocated for closed-captioning. The hearing disabled argument here is that crawls covering closed-captioning would prevent the hearing disabled from "watching" television as alerts are given.

In-home alerting devices

As a compromise, the SCTE has proposed allowing operators to choose between two approaches, both of which would accommodate the hearing-impaired: video override or audio override plus technologies that would activate in-home devices to alert the public of emergency situations. In this case, a cable system could use the headend controller to interface directly with the inexpensive audio override system while providing the same information via an in-home subscriber terminal that can provide visual information to the hearing disabled.

For a non-emergency event (a thunderstorm watch, for example), the controller activates a red light on the home unit. For emergency or potentially life-threatening situations, the in-home unit activates the in-home signaling system or a flashing light that alerts users of important information. By pressing a button on the unit, the hearing disabled can view a text message read-out which then resets the device. As an additional safety feature, the alert will stay activated until the subscriber responds. This capability allows even those who are out of their homes to receive the alert.

In-home alerting devices–in conjunction with an audio override system–provide a flexible and economic way to meet the new EBS rules. Since approximately 3 percent of the population are hearing disabled, placing in-home units only in the homes of the deaf and profoundly hard of hearing can be more economical for some cable systems.

The in-home alerting device can also be made available to the remaining subscriber base. During normal operation, the units provide the local weather forecast and utilize the red light (non-emergency) or a siren (major emergency) to alert subscribers. By pushing a button the unit could provide information to the public without the need to have the television set turned on or viewed.

Other benefits to in-home alerting devices include enhanced public relations; cable systems could begin to promote a commitment to provide enhanced local information that could attract non-subscribers. This alone could provide a competitive advantage. Such local alerts as school closings, water main breaks, major traffic accidents, etc., could be carried on the system to any given zone, providing subscribers with a means of keeping up to date on changing conditions in their own communities.

In the end

Before now, cable systems have not had to comply with the Emergency Broadcast System; however, cable's penetration rates mean more people get their news and entertainment over cable television networks. Recognizing this fact, the new EBS rules will mandate that cable systems, in addition to radio/TV broadcasters, implement specific EBS equipment that can deliver national emergency information to the public.

While solutions to meet the new rules will vary depending on the size and penetration of a particular system, what's clear is that operators will need to come up to speed quickly on how best to comply cost-effectively. In the end, the major choice will lie in deciding whether to deliver only national warnings or providing more comprehensive local alerts as an additional service to subscribers. CED

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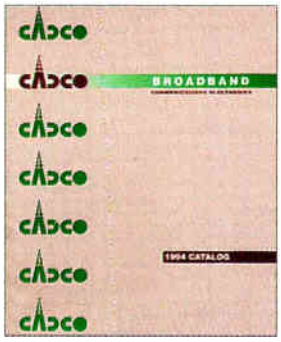

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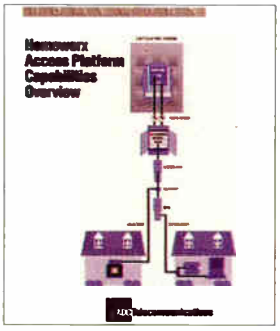

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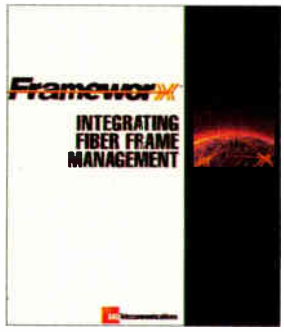

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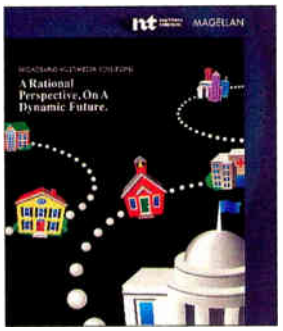

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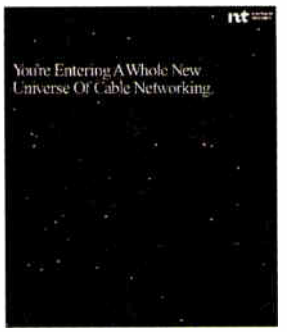

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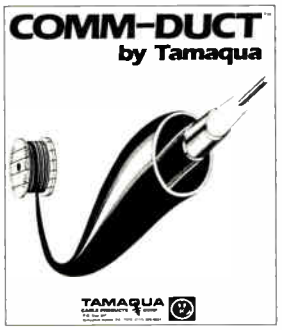

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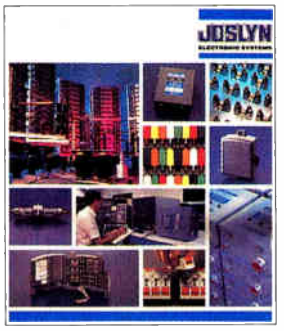

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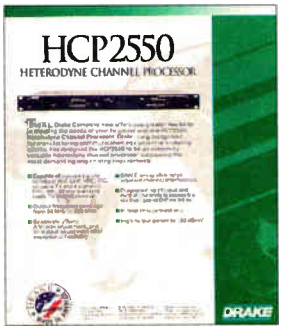

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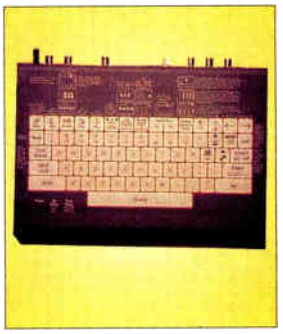

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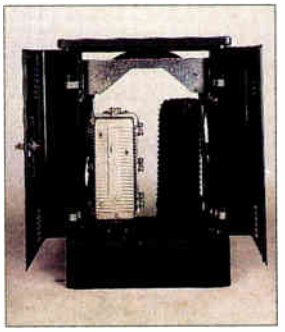

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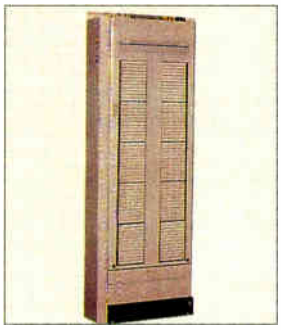

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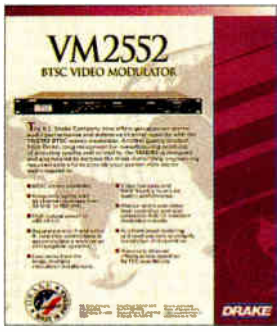

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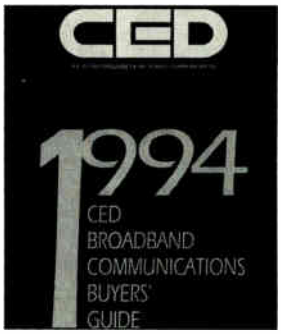
Flexcell™, from Teleflex Information Systems, Inc.®, is the billing and information management system that encompasses a full range of functionality for cellular, paging and cable operators. Flexcell is UNIX-based and utilizes symmetrical multiprocessing to enable production of 50,000 bills in 64 minutes. **Teleflex Information Systems**, Inc., 7736 McCloud Road, Greensboro, NC 27409; (910) 605-3205.

Circle Reader Service No. 172

1994 CED Broadband Communications Buyers' Guide

In addition to CED's hard-hitting monthly coverage of the Broadband Communications industry, only CED provides the industry with the annual CED Broadband Communications Buyers' Guide. Published in May 1994, the guide is the industry's one-of-a-kind resource for complete listings of hardware manufacturers, distributors, repair centers and service providers. COST: First copy free with CED subscription. Add. copies: $49. *CED Magazine* (800) 888-4824.



Circle Reader Service No. 173

1994 NCTA Show New Orleans

The following technological companies will be exhibiting at the 1994 NCTA Show, New Orleans:

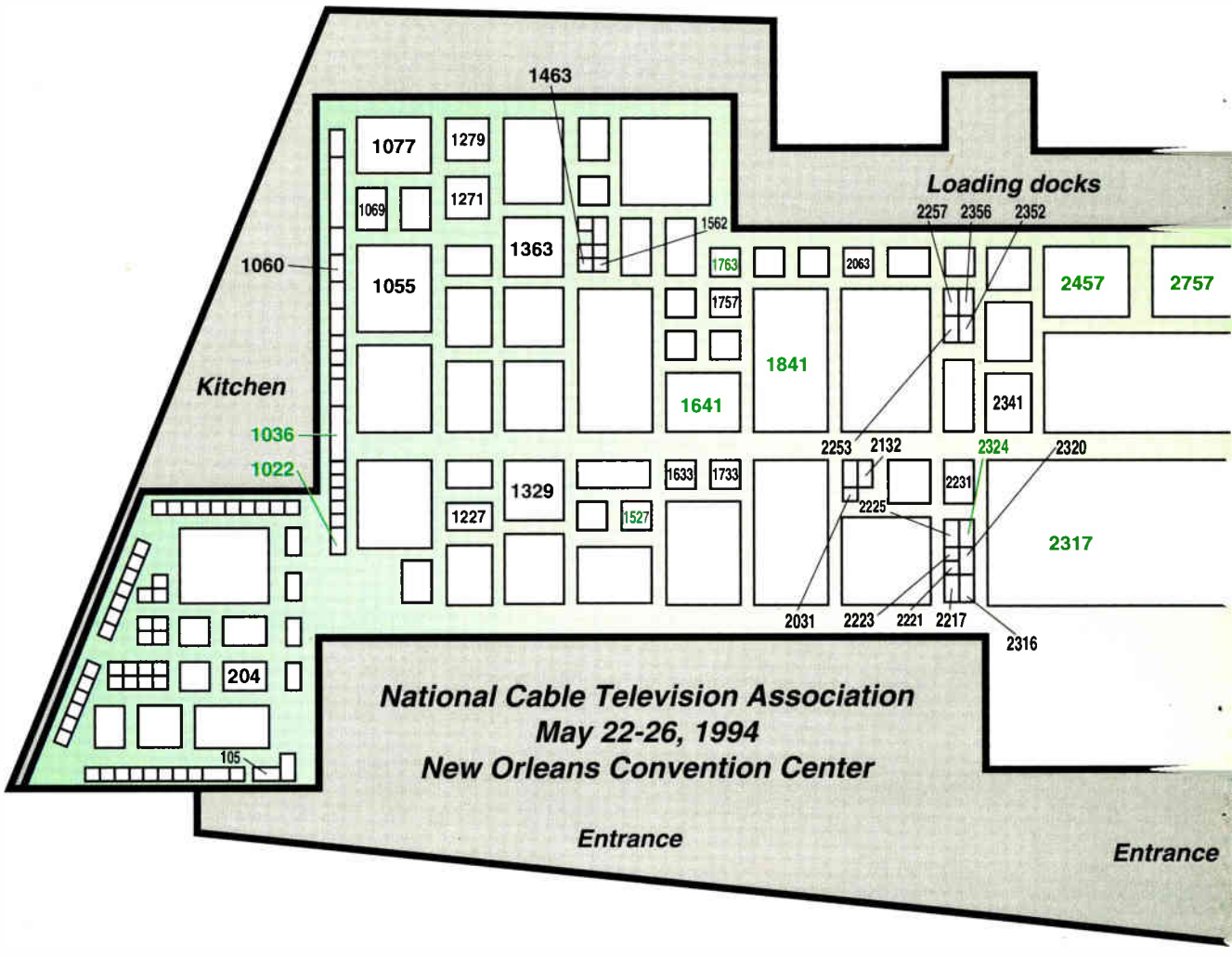
Advanced Telecomm. Solutions.....3807
Phone.....908/636-1700
ATS is an integrations innovator within the telco/cable industries, providing operators with customized solutions to meet their rapidly changing environment. ATS offers FSMS™, the premier field service management system that provides a complete end-to-end workforce management tool. FSMS™ incorporates global positioning, computer aided dispatching, geographic information and mobile data terminals into one seamless tool that works in concert with your existing critical support operations. It is one of the many solutions designed to help maintain a competitive advantage in today's converging marketplace.

Alcatel Telecomm. Cable.....1463

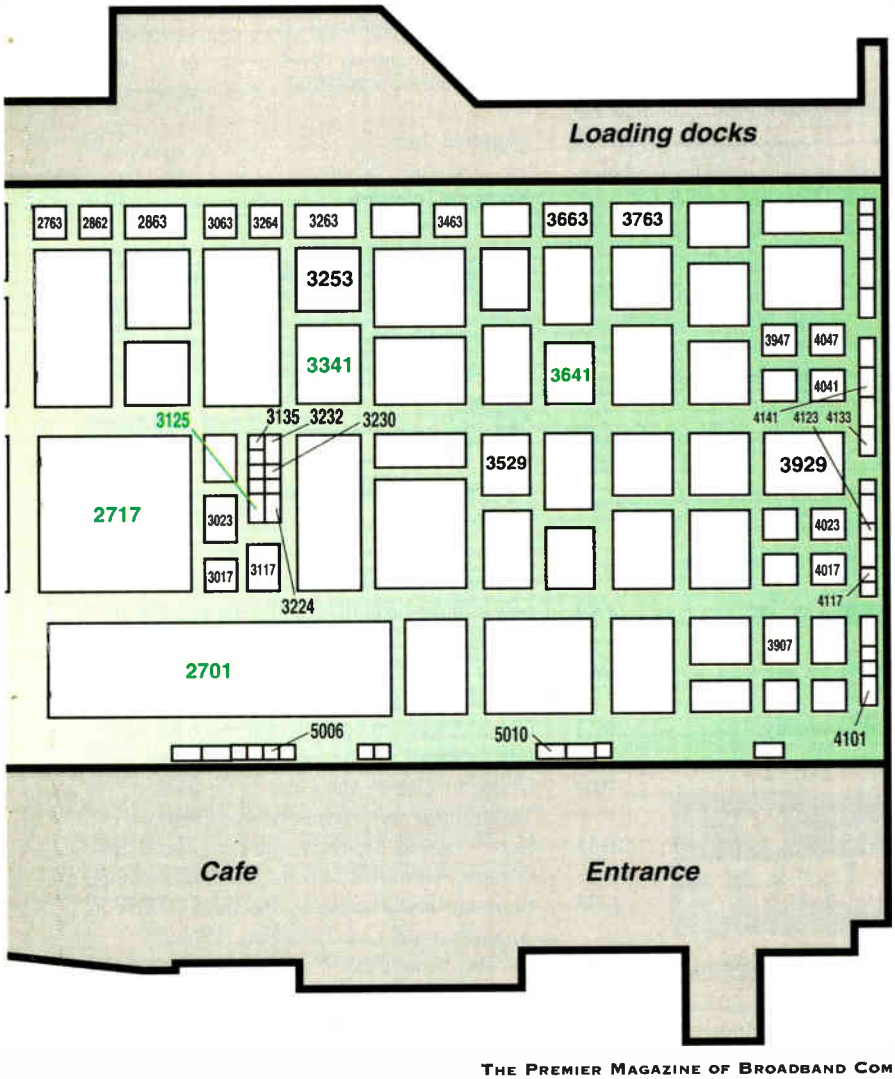
Alpha Technologies.....1757

American LightwaveSystems.....1227

ANTEC.....2717
Phone.....708/439-4444
ANTEC is an international technology integration company specializing in the design, engineering, manufacturing, materials management and distribution of products for fiber and coaxial broadband networks. Through the development of the Cable Integrated Services Network (CISN), ANTEC established a



migration path for cable television systems to upgrade to interconnected networks and the PSTN (Public Switched Telephone Network) using the SONET (Synchronous Optical Returns) platform. CISN offers cable operators a revenue-driven building approach that requires new capital investment only where the market can support new services. At the NCTA, ANTEC will feature a "walk through the network" with displays for a variety of key broadband products and services including the SONET-compatible DVC Digital Video Codec; the Laser Link family of distributed feedback laser transmitters; the fully redundant, bi-directional-capable Gateway Optical Receiver; the Cable Loop Carrier 500 residential telephony system; the Integrate Drop System that brings high integrity to subscriber drops; the Regal line of 1 GHz subscriber taps, house and line passives, as well as Materials Management programs and Broadband Technical Training programs.



FIRST DATA CORP. CABLE SERVICES GROUP

Cable Services Group 1641
Phone.....402/222-7475

Cable Services Group, a business unit of First Data Corporation (FDC), is a leading provider of management information systems and innovative technologies for the cable television and TVRO industries. In addition to its online management information and billing systems (Cable Control System), CSG will be demonstrating VIP an easy-to-use, realtime analytical tool, and ACSR which can increase the productivity of the cable office.

cable data

Gain from the experience

CableData.....2757
Phone.....916/636-5841

CableData, the world's largest transaction mnagement systems supplier, serving over 33 million cable and telephony subscribers, exhibits its DDP/SQL™ system and Intelecable™, integrated cable/telephony transaction management system. CableData's International Billing Services provides statement production and mailing services to over 50 million subscribers in CATV, telecomm and other industries.

CONTEC™ INTERNATIONAL

Contec 1036
Phone.....518/382-8000

CONTEC repairs cable TV converters, head-

PRODUCT/SERVICES

CED Product/Services Update offers the latest equipment and services available. Many of these are featured at Cable '94, The National Show.

Each update features a reader service number. Additional information is available FREE by simply completing the reader service card located between pages 66 & 67. Make the most of this special service by making your request NOW!

ACCESSORIES

Circle Reader Service No. 100

ADDRESSABLE SYSTEMS

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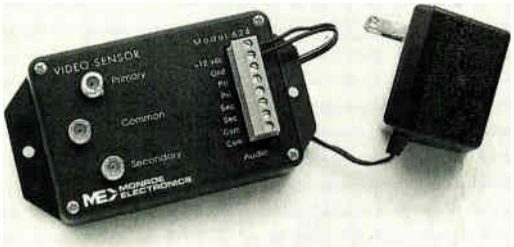
Circle Reader Service No. 111

Circle Reader Service No. 112

Circle Reader Service No. 113

Model 624
VIDEO SENSOR



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Monroe Electronics is happy to introduce the new Model 624 VIDEO SENSOR which provides automatic 2X1 audio-follow-video switching by monitoring the loss of horizontal sync pulses. When video is lost on the primary source the 624 will automatically switch to the secondary video source until the primary source returns. With the 624's small size; easy installation; and low price the Model 624 VIDEO SENSOR is cheap insurance against lost video. So call Monroe today and we'll be happy to help eliminate your loss of video problems!

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Great Lakes Expo, Booth 431 Eastern Cable Show, Booth 121

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.2–1000 MHz In One Sweep!

AVCOM's New PSA-65A Portable Spectrum Analyzer

The newest in the line of rugged spectrum analyzers from AVCOM offers amazing performance for only **$2,855**.

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Circle Reader Service No. 117

Subscriber nightmare: Believe it or not

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

Ralph Patrick has a problem. That is not his real name, of course, but here is how he described his problem in a letter to his local newspaper. Names have been changed to protect the innocent. Emphasis has been added. Otherwise the letter is verbatim, and complete:

"Breakdown on the information highway.

Of all the wonders said to be speeding my way on the "information superhighway," the one I await most is a competitive cable television industry that will spare me the ineptness of (Videopolis Cable Corp.)

I have been trying to have cable installed in my house for a month. After six installation appointments, I'm still spinning my rabbit ears, trying to coax a picture through the blizzard of snow that is my television screen.

The first three installation appointments went like this: The cable technician arrived, discovered he needed special equipment and said he'd be back with the right tools in a few days. The next time, a different installer arrived, minus the right equipment.

For Appointment No. 4 and Appointment No. 5, no one showed up. I demanded that Appointment No. 6 be scheduled for Saturday morning, so I wouldn't have to miss any more work. (Videopolis Cable) agreed.

Saturday morning came and went. No technician. I called the cable company. (Videopolis Cable's) so-called customer service department told me that the installer wasn't supposed to have come on Saturday but on Tuesday between 10 a.m. and noon. I said, no, Tuesday was unacceptable, because I needed to earn a paycheck to pay my cable bill. I was told I had no choice, which is true since I could hardly threaten to take my business elsewhere.

I asked to speak to a supervisor and was told that she was busy and would call me later. I demanded that the company send someone over before the end of the weekend. No go, I was told. I scheduled Appointment No. 7 for the following Saturday. Much to my shock, the installer actually came and had the right equipment.

The other good news is that my friend who designs cutting-edge information systems for the phone company told me recently that in a year or so it will be possible to get cable television over the phone line.

By then, if stress and frustration of dealing with (Videopolis Cable) haven't done me in, I'll relish the opportunity to cancel my "service" and buy from a competitor who may just put my tormentor out of business."

Well, Mr. Patrick, are you really yearning for a "competitive cable television industry," or are you willing to swap one monopoly for another? If the phone company puts Videopolis Cable out of business, to whom will you turn when the phone company jacks up the price? Classical monopolies have been known to do just that. The phone company, after all, has been a monopoly for 100 years.

Even after making allowance for some puffery and exaggeration growing out of extreme frustration, the fact remains that Mr. Patrick's complaint is not as rare as it should be. Nevertheless, Congress and the FCC appear to be overreacting to the exasperated accusations of a vocal minority. Is it possible that telco lobbyists and other competitors might encourage such a response?

Without minimizing the allegations or denigrating the motivation, my experience indicates that a dispassionate overview would clearly demonstrate widespread, although obviously not even close to unanimous, satisfaction with both service and prices. Satisfied people seldom write to editors or Congressmen about it. In some cases, high prices and poor service may have been a consequence of the highly leveraged "junk bond" acquisitions prevailing in the 1980s. The cable industry is not alone in this predicament.

Cable TV not a classical monopoly

It should be noted that cable TV is not a monopoly like the telephone company. The off-air programs of the TV networks are receivable on relatively simple antennas in all suburban metropolitan areas. Most satellite network programs are available on individual dishes, by payment of access fees comparable to cable TV service charges. Wireless cable is growing rapidly.

If the backyard dish is unappealing, or not even feasible, the most popular movies are also available at thousands of video stores, for quite nominal rental fees.

If you are turned off by the aesthetics or cost of the backyard dish, or the aggravation of returning rental tape cassettes, why not try cable TV as an alternative? Monopoly, is it? What alternatives are there to telco service? A taut string between tomato cans? Ham radio? CB? Why do nearly 35 million households that could get cable TV choose not to do so? Certainly not because it is a monopoly. Can you think of anyone who does not have a telephone? That is monopoly, for sure.

Telcos tell us they will provide the highest quality TV service, on demand, promising the convenience of video cassettes, with none of the aggravation of which Mr. Patrick complains. We have yet to see it demonstrated, and no one talks about prices. The evidence in the PacBell case, and others, suggests that if prices for video are to be competitive, they are likely to be subsidized by telephone rate payers.

Mr. Patrick's complaints may, or may not have been stimulated by his friend who designs futuristic systems for the phone company. In any case, too many such complaints are genuine and not to be condoned. Unfortunately, our wannabe competitors would probably not get off our backs, even if there were no genuine service complaints.

Believe it or not. Hardball competition is no picnic. CED

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Our Cable Integrated Services Network (CISN) is a "blueprint" for building a broadband network that accommodates interactive services in a 1 GHz spectrum. The Regal family of products by ANTEC supports this vision.

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